THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXV.—No. 7. Whole No. 415 | NEW YORK, MONDAY, OCTOBER 2, 1876. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, Editor,

CONTENTS.

☞ An asterisk (*) denotes an illustrated article

EDITORIALS—
To the Members of the American Gas-Light Association..... 153
The Price of Petroleum..... 153
Extracts from the Report of the Berlin Municipal Gas-Works for 1874-5..... 154
North British Association of Gas Managers..... 154
The Manufacture of Coal Illuminating Gas..... 156
North British Association of Gas Managers..... 157
River Protection at Plattsmouth, Neb..... 158
The Importance of a Knowledge of the Laws of Health.... 159
Saving the Gas..... 159
CORRESPONDENCE—
Letter from Mr. Kidder..... 160
The Lowe Process..... 160
Gas-Light Intelligence..... 160
Chemical and Scientific Repertory..... 160
Sanitary Drainage..... 161
New Gas Lighthouse on the South Coast of Ireland..... 161
Natural Gas for Heating Purposes..... 161
Report of the Committee of Science and the Arts on the Dioptric Light of Gen. M. C. Meigs..... 162
New Galvanic Battery..... 162

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

The price of this Journal is, in advance, **$3.00 per Annum. Single Copies Fifteen Cents.**

☞ NEWS AGENCY.—The American News Company, 119 and 121 Nassau street, New York agents for this Journal. News dealers will please send orders to them.

☞ All communications to be addressed to **"The Proprietors,"** No. 42 Pine Street, Room 18, New York.

TO OUR SUBSCRIBERS AND PATRONS.

In making remittances for subscriptions, always procure a draft on New York, or a POST OFFICE MONEY ORDER, if possible. Where neither of these can be procured, send the money, but always in a REGISTERED LETTER, The registration fee has been reduced to eight cents, and the registration system has been found by the postal authorities to be actually an absolute protection against losses by mail. ALL Postmasters are obliged to register letters whenever requested do so.

NOTICE.

☞ *All Collections for Advertisements, Subscriptions, etc., are made directly from this Office. We have Agents to solicit the same, but they are not authorized to Receipt for Money.*

TO THE MEMBERS OF THE AMERICAN GAS-LIGHT ASSOCIATION.

OFFICE OF THE AMERICAN GAS-LIGHT ASSOCIATION,

117 BROADWAY, NEW YORK, Aug. 31, 1876.

The Fourth Annual Meeting of the AMERICAN GAS-LIGHT ASSOCIATION will be held at CHICKERING HALL cor. 5th Avenue and 18th st., New York City, on the 18th and 19th of Oct., at 10 o'clock, A. M. Arrangements have been made for special cars to Philadelphia in case a sufficient number of members desire to visit the Exhibition after the adjournment.

CHAS. NETTLETON, SECY.

PRICE OF PETROLEUM.

On July 18th petroleum was quoted at 9 cents for crude and 15¼ for refined in New York. On Sept. 28 the quotations were 14c. for crude, in bulk, and 18¼c. in bbls., and 26c. for refined. Naphtha was 14c. By an actual gauge of all the tanks in the oil regions of Pennsylvania, at the end of August, the total amount of merchantable oil, as given in the Titusville *Courier*, was—3,164,384 bbls., and it is expected that this amount will be reduced during the next three months, and that the prospects of much of a decline are very distant. At the present low price of coal and higher price of oil, gas made from the former is not only better but cheaper. In this connection we give the following from *Iron Age*, Sept. 7th, believing that what is said about the use of oil in iron manufacture applies much more closely to its use for gas making.

"The history of petroleum is a romance full of lights and shadows, and abounding in the most dramatic surprises. Towns have sprung up in a night almost, and been deserted as rapidly. In three months from the time oil was struck at Pithole, a town of 10,000 inhabitants was in existence, and in a short time they have stolen away as silently as the Arabs, but unlike them had left their tents behind. The present advance in the price of crude is another of these surprises. Some weeks ago we ventured to predict $3 oil. As we write it is selling at $4 at the wells. Two years ago it was selling at 40 cents or even less. It is this liability to such great fluctuations that renders it so difficult to decide on the advantages of the use of petroleum in iron making. When oil is less than $1 experiments in this line are active, and there is some profit in using it, but the case changes when oil is $4."

We give below an article from the Titusville *Courier* upon the results of the gauging referred to above.

"The report of the comprehensive result of gauging all the tanks in the oil regions, including certain tanks at Pittsburg, is published elsewhere in the *Courier*. We incline to the opinion that the report is substantially correct, and that the work has been faithfully done. It furnishes proof that the public report of Stowell, and the private reports of Babbit and Welsh are at least approximately correct. We are of the opinion that this late measurement will have a good effect upon the market. We may now assume to know how much oil we have now in the region. That amount is between three and three and a-half million bbls. of crude. We are glad to know there is so much oil. It is so much wealth, and if there were a million barrels more, it would assure to the region so much more money. A half million barrels of stock does not affect the market one way or the other. As the stocks are held here in the region, it would be a positive calamity to have them reduced below two million barrels. We need this amount, as a magazine to draw upon, to steady the trade. As the feeling of uncertainty as to the amount of oil is now removed, we shall expect an improvement in prices. The market in Antwesp went up yesterday to 49½ francs. The stocks during the remaining four months will be reduced at least a million and a half barrels. We assure our friends that the prospects of the oil trade are extremely bright. We ask to be held responsible for this encouragement to holders of oil."

Extracts from the Report of the Berlin Municipal Gas Works for 1874-5.

[Translated from *Journal fur Gasbeleuchtung.*]

By T. H. MULLER.

Gas produced.....55,886,000 cu. meters.
Gas produced previous year 51,746,400 "
Increase..... 4,139,600 "

or 8 per cent., while the increase during 1873-4 had amounted to 12·546 per cent.

This total amount was furnished by stations at

Stralauer Platz.....	6,050,000 c. m.	or 10·8	p. c.
Greifswalder strasse.	10,530,000 "	" 18·8	"
Gitschiner Strasse..	17,910,000 "	" 32·1	"
Muller strasse.....	21,396.000 "	" 38·3	"
Total.....	55,886,000	100	

The total consumption during the year was

55,859,500 cubic meters for (July 1st, 1875) 9,717 public, and 495,531 private burners, with an increase over previous year of 697 public and 57,581 private, or a total of 58,278 burners, or 13.038 per cent.

The above consumption was—

For Public Lamps.....	6,679,207	or 13·2 p.c.
Used in works (including 21,030 cubic meters for blowing out new apparatus	633,559	or 1·3 p.c.
For private consumers....	43,296,623	or 85·5 p.c.
	50,609,389	100·
Unaccounted-for gas, including leakage, etc.....	5,250,111	
Total.....	55,859,500	

Compared with the total consumption, the unaccounted-for gas amounts to 9·399 per cent.

The annual burning hours for public lamps have been increased from 3,600 to 3,675, with an annual consumption of 708,876 cubic meters.

The average consumption per private burner amounted to 91·158 cubic meters, which shows a decrease over previous year of 5·534 cubic meters as the average consumption for 1873–4 was 96·692 cubic meters; this decrease is attributed to the depressed state of trade, so that there is no fear entertained on this account—as, with the return of an improved trade, an increased consumption under this head may be expected.

The highest daily production, on the 16th of December, amounted to 282,200 cubic meters, while the largest consumption falls on December 22d, with 288,200 cubic meters.

The least daily production was on July 4th—61,200 cubic meters: the least daily consumption was on July 5th—53,850 cubic meters.

The proportion of the smallest daily consumption to the maximum daily consumption was therefore as 1 to 4·709; and the proportion of maximum daily consumption to the total yearly consumption as 1 to 193·8

The maximum amount of gas sent out in one hour was 33,950 cubic meters, or 11·780 per cent. of the amount of the maximum day.

For the production of the 55,886,000 cubic meters of gas there was required 203,762·35 tons of coal. The average yield per ton of coal was, therefore, 274·27 cubic meters, against 274·86 cubic meters for 1873–4. This decrease, although small, is owing partly to interruptions of the running of the station in the Greifswalder strasse, partly to the use of small coal. The interruption in the Greifswalder stasse consisted in the burning of the engine house when, by the falling of the iron roof, the engine and exhausters were considerably damaged, and much gas lost. This accident was on Oct. 24th. Work was commenced again on October 26th, without exhausters, which were not started again until November 24th. During the stoppage of the exhausters the yield was reduced to 248 cubic meters average per one ton of coal.

The total number of charges made was, 1,456,040. The average production of each retort for 24 hours was 191·9 cubic meters. The largest number of retorts fired on any one day was 1,489 in 213 benches.

The total amount of gas produced by one retort, during its life, was 82,306 cubic meters= 2,906,189 cubic feet.

The gas was tested at the works by the officials and in the city, at a distance of 2,500 meters from the nearest station, by Professor Rudorff, for purity and candle power (16 candles for 150 litres per hour) equal to 5·29 feet.

The total length of mains at the end of June, 8175, was 493,349 meters (1,609·315 meters=one mile) with an average sectional area of 38·708 square milimeters (about 8¼ in. diameter.)

The 202,762·35 tons of coal carbonized gave 125,028·35 tons of coke, 4,755·1 tons of breeze, and 1,233 tons of ash.

Tar produced.....	9,665 tons
Value of same.....	453,742·39 Marks.
Ammonia-water produced.....	16,911 tons
Value of same.....	85,835·52 Marks.
Other side products..	10,663·09 Marks.

Total amount of coke consumed at the works—47,748·9 tons.

The purifying material is exclusively bog-ore, from the neighborhood of Haynau in Silesia. Experiments made with other materials have not given such results as to warrant the discontinuance of the use of iron ore.

The expenses (superintendence, lighting, cleaning, etc-), for one public lamp burner, averaged during the year, 16·26 Marks.

A part of the city is supplied by the Imperial Continental Gas Light Company, comprising 263 public lamps, so that the total number of street-lamps at end of June, 1875, inside the *city limits*, amounted to 9,980.

1 cubic meter=35·31 cubic feet.

Dusseldorf Municipal Gas Works, 1874–5.

Total gas produced.....4,281,710 c. m.

Private consumption....3,158,876	c. m.	73·7	p. c.
Street lamps.....	661,782 c. m.	15·4	"
Consumption at works..	53,517 "	1·3	"
Loss	411,635 "	9·6	"

Maximum daily consumption,	Dec. 31,	21,936 c.m.
Minimum " "	July 7,	5,611 "
Average " "		11,739 "

Coal carbonized—

Westphalia coal, (Hibernia Consolidation, and Zollverein Mines).....	280,307 cwt.	=98·2p.c.
English Boghead.....	5,190 cwt.	= 1·8p.c.
Total.....	285,497 cwt.	

Yield—1 cwt. of coal=14·99 cubic meters gas.

In December 92 retorts were fired each day, while in June only 26 retorts were used. The average amount produced per retort, per day, is 219·24 cubic metres.

Coke produced—69·59 per cent. of coal carbonized.

Coke consumed—22·8 per cent. of coal carbonized.

Tar produced—13,648 cwt., or 4·78 per cent of coal carbonized.

Sulphate of ammonia produced—936·04 cwt.

No. of street lamps.....	1062
No. of private consumers.....	2859
No. of Meters.....	3059
Total length of mains...	104,757 meters.

NOTE.—1 cwt.=110·2 lbs. avoirdupois

North British Association of Gas Managers.

[From London "Journal of Gas-Lighting."]

The fifteenth Annual General Meeting of the Members of this Association was held on on the 14th of July, in the Royal Scottish Society of Arts Hall, 117 George Street, Edinburgh. Mr. Samuel Stewart, President of the Association, occupied the chair.

Mr. Young (Clippens) read the following paper on—

THE UTILIZATION OF THE GASES RESULTING FROM THE DESTRUCTIVE DISTILLATION OF SHALE IN THE MANUFACTURE OF PARAFFINE OIL.

When coals and shales are subjected to destructive distillation at the lowest temperature, which will decompose them, and liberate their volatile constituents (as is the case of the manufacture of crude paraffine oil), there is always produced, along with the large quantity of condensible liquid products, a considerable volume of permanent gases. These gases very much resemble such as you are every day making for the supply of your various communities; and I have no doubt that many of you, when travelling through the oil manufacturing districts, and seeing the large volume of gases which the oil manufacturer allows to escape into the air, have experienced the desire to have your holders attached to his waste-gas pipe.

There is not the least doubt that the best mode of utilizing these gases for illuminating purposes is to supply them direct to the consumer, where this can be conveniently done. Young's Paraffine Light Company have for a considerable time supplied from their works the town of Bathgate and the village of West Calder with the gases resulting from the distillation of the shale for oil. But, almost as a rule, oil works are, from the nature of the material used, necessarily located where the shale or coal is raised, and at considerable distances from towns of sufficient size to take anything like the quantity produced; and further as the make of oil, and consequently, the make of gas, is the same all the year round, it is evident that there would be a large surplus of gases during the summer months, and that, if those gases are to be used for the purposes of illuminating, some special means must be employed for their application. It is more especially to those means that I wish to draw your attention to-day.

As I have already stated, the crude gases resulting from the destructive distillation of shale and coal in the manufacture of paraffine oil are, in their constitution, very similar to those you are making every day for the supply of your consumers—consisting, as you are aware, of non (or feebly) luminous combustible gases; illuminating gases, and the vapors of hydrocarbon fluids diffused through those gases; and lastly, the impurities—sulphuretted hydrogen (and perhaps other sulphuretted compounds) carbonic acid and ammonia.

The only essential difference between ordinary illuminating coal gases and the gases from shale-oil works is, that in these latter there is scarcely a trace of bisulphide of carbon or cyanogen compound, and that they contain comparatively large volume of the hydrocarbon vapors diffused through them, and to which they are principally indebted for their illuminating power, those hydrocarbons belonging principally to the marsh-gas group of compounds or paraffines; whereas those in ordinary coal gas belong principally to the olefiant gas and benzole groups.

Seeing that, in so far as illumination is concerned, the non-luminous gases are comparatively valueless; and further, seeing that the shale gases derive their illuminating power principally from the vapors of very volatile hydrocarbons diffused through them, it will be evident to you that, were it possible by any convenient means to convert those vapors into a liquid portable form, many of the difficulties of applying the waste shale oil gases for the purposes of illuminating would be overcome.

There are various means of depriving a gaseous body of the vapors diffused through it—thus, if we desire to deprive a gas of watery vapors, we pass it over or through some substance, such as sulphuric acid, or chloride of calcium, which, having a strong affinity for water, absorbs and removes the watery vapors: or, if we subject the gases to intense cold, the vapor tension is so far

reduced that the waste vapor is in a great measure deposited; or by compressing gases, and thereby reducing their volume, their capacity for holding vapor in diffusion is thereby lessened; thus, by doubling the pressure on gases, their volume is reduced by one-half, and their capacity for holding vapor in diffusion halved also.

Some years ago, my late brother-in-law, Mr. G. F. Cusiter, was appointed by this Association one of a committee to investigate as to the utility of glycerine as a substitute for water in the wet meter. During a visit which I paid him at the time of the trials, he mentioned the subject; stating that the results from the use of glycerine were not all satisfactory, and that he had been fishing about for other substitutes. I suggested the use of intermediate paraffine oil as a likely liquid, seeing that it would neither freeze nor evaporate, and that as it was not mixable with water, any water condensed in the fittings and finding its way into the meter could be easily separated and drawn off; it would also act as a good ubricant, and prevent the destruction of the metal of which the meter was composed; and lastly, as it was a comparative drug in the market, it could be got cheap.

I supplied him with samples of this oil, with which he filled the meter he had been using for the experiments with glycerine, when we were both much surprised to find that on turning on the gas it had last the greater part of its illuminating power, in consequence of the oil having an absorbent power for the illuminating constituents in the gas.

Being then personally engaged in the manufacture of crude paraffine oil, the discovery naturally suggested the application of this oil for the absorption and recovery of the very volatile hydrocarbons diffused through the waste shale gases. After a long series of experiments, extending over a number of years I have succeeded in perfecting a process whereby, by employing this oil either without or in conjunction with pressure and cold between 60 and 80 per cent. of the total illumina ting power of the gases resulting from the distil lation of shale for oil is recovered in the form o this volatile liquid.

To describe the process would extend this paper to an inordinate length. Suffice it to say, that its simplest form it very much resembles that described before the British Association at their in meeting in London in 1870, by Mr. Livesey, as Mr. Hill's process for employing ammoniacal liquor to remove sulphuretted hydrogen from coal gas, the absorbent oil taking the place of the ammoniacal liquor, and the sulphuretted hydrogen representing the hydrocarbon vapors. To those desiring more information on the subject, I beg to refer them to the specification of patent dated 7th September, 1875 (No. 3137).

Before proceeding to refer to the various ways in which this fluid may be applied for illuminating purposes, I wish to make a few remarks upon the wonderful affinity those hydrocarbons have for the sulphuretted compounds present in the crude gases. The oil employed to absorb the vapor of this sample of fluid from the gas was free from sulphur compound, and the vapors were distilled from the oil in an atmosphere of steam upwards of ten times their volume, yet they have held on by the sulphur compounds; for, you see that when I bring these into contact with a solution of a lead salt in this test tube, the black sulphide of that metal is at once formed, and in such abundance that the whole becomes a pasty mass. As to what is the nature of the sulphur compounds, I am not in a position to say much, having made few experiments likely to throw light on their constitution; and any experiments which I have made in that direction have been of a very practical character.

In the treatment and preparation of the hydrocarbon fluids for the market, it, of course, was essential that they be freed from all sulphur compounds. As a ready means of accomplishing this object, the passing of the fluid through a bed of moist peroxide of iron suggested itself, but in how far it was successful, you will gather from the following experiment:—

I have here a sample of the crude hydrocarbon fluid, which I will divide into two portions: the one I will pass through this filter filled with peroxide of iron, and the other I will pass through this other filter, containing moist hydrate of lime. Now, in my opinion, if the sulphuretted compound consisted of the simple gas-sulphuretted hydrogen, dissolved in the hydrocarbon fluid, the hydrated oxide of iron should absorb and remove every trace of it; but, to show that such is not the case, I have only to add a little of this hydrocarbon standing over the oxide to the solution of a salt of lead contained in this test tube, when you see that a sulphide of the metal is at once formed, though not in the same quantity as before. Such is not the case with the sample treated with the caustic lime; for, as you see, the lead salt is not at all affected, showing that the oxide has not the power of removing certain sulphur compounds which are removed or decomposed by lime and salts of lead. This sulphur compound, whatever may be its constitution, must be very volatile, for it nearly all passes over with the hydrocarbon vapors during the earlier stages of the distillation.

As it is possible that similar sulphur compounds are present in ordinary coal gas produced during the earlier stages of the carbonization, when the temperature is comparatively low, it is quite possible that lead paper may be blackened and yet it may not be due to sulphuretted hydrogen. This experiment further points to the superiority of lime as a purifying agent.

As I have already stated, the hydrocarbon fluid represents from 60 to 80 per cent. of the illuminating power of the waste shale gases from which it was absorbed and isolated by means of the heavy oils. It consists of a large number of distinct hydrocarbons, some of which, when separated from the rest, are permanently gaseous at ordinary temperatures; for, on subjecting the fluids to distillation, there is a portion which escapes condensation, even although salt and pounded ice be employed as the condensing medium Those very volatile fluids are held in solution by the denser hydrocarbons present, a small portion of which have a boiling point as high as 350 degrees Fahrenheit.

I have here a sample of the more volatile portions of this distillate in this strong flask, which has been condensed at low temperatures. You observe that on opening the stop-cock in the mouth of the flask, and thereby relieving the pressure, the contained fluid commences to boil; the temperature of my hand being sufficient to liberate the most volatile portions in the form of gas or vapor. I will now allow a little of the fluid to escape into this test-tube, to which I have previously added a portion of this fluid, which belongs to the denser portion of the distillate, boiling at 140° Fahr. You observe that the boiling immediately ceases, for the pressure of the denser hydrocarbon reduces the vapor tension of the more volatile, and the whole is thus kept in a fluid state under ordinary atmospheric pressure.

In a similar way, when shale gases are subject to considerable pressure, the tension of the gases themselves is not nearly so great as that of a similar volume of a purely gaseous body; because, as the pressure increases, and the tension of the hydrocarbon vapors is overcome, and they are condensed into the liquid form, they, at the same time, absorb or dissolve a portion of the permanent gases, more especially those gases giving, when burned, a considerable amount of light. And I am of opinion that the shale gases might, from their comparatively easy compressibility, be advantageously transported for direct consumption for illuminating purposes; for, by having railway wagons furnished with strong malleable iron reservoirs, 15,000 to 20,000 cubic feet of gas could be easily stored and thus conveyed to where it was required, and then emptied into the gasholder, drawing the gases from the reservoir at the lowest point, and passing through a suitable vessel, that the condensed hydrocarbons might be revolatilized into the transferring gases.

There are various means of applying those hydrocarbons condensed from shale gases for illuminating purposes; one of the simplest being to reconvert them into illuminating gases by diffusing their vapors through some permanently gaseous body, a combustible gas being preferred, such as water-gas, hydrogen and carbonic oxide, or poor coal gas: but where that cannot be obtained, even atmospheric air may be employed.

I have here an ordinary bromine test-tube, the bulb of which is filled with air and the stem with water. I will now introduce a little of the hydrocarbon, just as you would a little bromine when testing for the condensable hydrocarbons in gas; by inverting the tube, I bring the hydrocarbon and the air into intimate contact, and on again bringing the tube into its original position, and removing my finger, you see how the hydrocarbon has volatilized into the air and increased its volume, and the whole of the water is driven out of the tube.

I will now take a little of this intermediate oil, and bring it into contact with the charged air. You see how quickly the vapors are re-absorbed by the oil, the test-tube being at once refilled, showing that the vapors have been absorbed and removed.

If I blow air through this Woolf's bottle containing a small quantity of this hydrocarbon, you see that it becomes so charged with vapor that it is combustible, or, in other words, it is formed into pneumatic gas. I dare say most of you have seen machines for the manufacture of this gas, and therefore I shall not at present refer further to the subject.

To use the hydrocarbon fluid in this manner, however, is very wasteful, as a considerable portion of it is consumed in heating up the incombustible nitrogen in the air, and in forming with the oxygen a combustible gas to intensely heat the particles of carbon or denser hydrocarbons resulting from the decomposition of the remaining portion.

A much more economical way of utilizing the vapors for the purpose of giving light, is to combine them with water gas, hydrogen and carbonic oxide, or other non (or feebly) luminous gas, in the manner described by Mr. R. P. Spice, at the meeting of the British Association of Gas Managers held last year, and to which I beg to refer you.

However, perhaps the best mode of applying this fluid, in so far as the members present are concerned, is for the purpose of enriching ordinary coal gas in place of cannel coal. I have here a Woolf's bottle, through which I will pass the gas supplied to this room. You see what a remarkably rich flame it produces. A gallon of this fluid added, in the form of diffused vapor to 1000 cubic feet of gas, increases its illuminating power from 10 to 12 candles.

Where none of the above modes of employing the fluid are available, it may be consumed in the ordinary vapor lamp which was used long ago for consuming a mixture of alcohol and benzole. I have here a lamp of that description, and you see how excellently the fluid burns in it.

I should have liked to have gone more practically into the application of this hydrocarbon fluid for the purpose of illumination, more especially that of enriching poor coal gases, showing the best means of applying them and the relative values, &c. Mr. M'Gilchrist kindly arranged for a series of experiments being made in his works at Dumbarton; but as I have already stated, the want of time has prevented these trials being made. However, I hope that, with the permission of the Association, at some future meeting, either Mr. M'Gilchrist or I shall be able to give you the practical results of those trials, and, in the meantime, I trust that even what I have been able to say has interested you a little.

On the motion of the *President*, a vote of thanks was accorded to Mr. Young for his interesting remarks.

The Manufacture of Coal Illuminating Gas.*

By Alfred P. Trautwein, M. E.

Continued from page 135.

It is now necessary to determine the proportions in which the several coals that have been selected will be used. It is proposed, in this connection, that the gas to be furnished by the projected works, when ready for distribution to the consumer, shall never have a lower illuminating power than that of 16·5 standard English sperm candles—when such gas is consumed in a standard argand burner at the rate of five cubic feet per hour.

Before proceeding, however, it might be well to state that in the following calculations it is proposed to use such data only as are developed in the daily routine of the gas works. This is not to be construed to the effect that the importance of so-called experimental works is not fully appreciated.

They are, on the contrary, most valuable adjuncts of our gas works, giving us a reliable clue as to the merits of the different gas coals. The utmost care is taken in these experiments, and the yield of gas per lb. of coal and the illuminating power are known to a nicety. It would hardly be considered justifiable, however, to base our calculations upon results of this kind, since it is evident that they cannot possibly be attained in practice.

Our caking coals will yield us, as already stated, about 9,500 cubic feet, of 16·5 candle gas, per ton. Our standard for the illuminating power was assumed at 16·5 candles; it is very desirable, however, to have a small margin of safety, and since it has been found of no advantage to decrease the yield, and thus increase the candle power, it is necessary to use a percentage of cannel coal. This precaution must be observed in the winter months particularly, since sudden changes of weather are found to seriously affect the illuminating power of the gas. During the milder portions of the year the use of cannel coal for the purpose of enriching is not so common, and many works use caking coal alone. Before determining the exact percentage for this particular instance, an element must be considered which was thus far been overlooked. Experiments by Mr. Lamson, at the Boston gas works, seem to indicate that the differences in the quantity and quality of the gas produced under different pressures are by no means insignificant. This pressure is due to the hydraulic seal, and in many cases it is necessary to add, a pressure due to the gas in the hydraulic main. Allowance is made for this by employing a greater percentage of enricher, and, consequently, in mid-winter the average practice of the works in this vicinity calls for 88 to 90% of Pennsylvania caking, and 10 or 12% of West Virginia cannel coals. Similarly, we might mix our coals in the proportion of 90% Penn and 10% Peytona coal, with the following probable results:

Penn caking coal yielding	4·25 c. f.	—16·5	candles.
Peytona cannel	"	5·89	"	—42·79	"
Mixture	"	4·41	"	—19·12	"

We may arrive at the same, or very nearly the same, result by proceeding in a different manner. We refer here to a method quite recently suggested by William Farmer, Esq., of New York City. He proposes to express the two most important qualities of the gas coal, viz.—the yield of gas in cubic feet per pound of coal, and the illuminating power of the gas, by means of a new term—and he suggests the word "candle-feet" for the product of the candle power into the yield. There is no reason why this term should not be generally adopted, and we will consequently make use of it in this connection. The following figures represent the candle-feet of our coals:

Penn	4·25 cu. ft.	—16·5 candles	=70·12 candle ft.
Peytona	5·89 "	—42·8 "	=252·03 "
Mixture is to yield	4·41–19·10 "		=84·23 "

Using the formula given by Mr. Farmer†, we find that the percentage of caking coal necessary to propuce this result is a fraction more than 91%, the remainder being cannel coal.

With a margin such as this, there would be no difficulty in supplying the gas of the desired quality. The yield of gas per ton of coal would be about 9,900 cubic feet, or, in round numbers, 10,000 feet; this would somewhat, though very slightly, reduce our margin in the candle power. The above mixture of our coals would also yield from 1400–1480 lbs., or 35–37 bushels of good coke, abou' 12 gallons of tar, and 13 gallons of ammoniacal liquor.

Having thus premised all that is necessary for the present on the subject of gas coals, we will proceed to the study of the processes and apparatus by means of which they are transformed into saleable gas.

THE MANUFACTURE OF COAL GAS

may be discussed with greatest convenience under three distinct heads, corresponding to as many separate operations.

First. The manufacture of the crude gas by destructive distillation of coal.

Second. The condensation of the liquid products of distillation, and the removal of mechanical impurities.

Third. The removal, by chemical means, of those constituents of the gaseous products which have a tendency to injure the illuminating power and the other good qualities of the gas.

These three operations being consecutive, they will be discussed in the order in which they were given. The two most important of the conditions which have to be fulfilled, in order to successfully carry on the destructive distillation of coal, are, in the first place, entire absence of air and 2dly, a temperature sufficiently high. This operation, therefore, of distilling or, as it is technically called, "carbonizing" the coal, is performed in closed vessels, or in what are known as

RETORTS.

For a long time after gas manufacture had assumed a practical shape, it was customary to make all gas retorts of cast iron; they usually had a "D" cross-section, and were from 5 to 7 feet in length. Their great first cost, however, as well as the fact that their life was very short, soon led to attempts to protect them from the direct action of the fire by means of fire clay "shield tiles." The wear from this source, however, was still quite considerable, and then, too, it had probably become evident that, in order to thoroughly utilize the coal for the purposes of gas manufacture, it would be necessary to carry a temperature much higher than that which was then possible; these were among the considerations which soon led to the substitution, for iron, of clay as the material for gas retorts. Fire clay retorts were first suggested by Mr. Grafton, a Scotch engineer, in 1820. For a long time, however, their introduction progressed very slowly; this is not, on the other hand, by any means surprising when we take into proper consideration the fact that, though cast-iron retorts were much more expensive than clay retorts, their great advantage over the latter consisted in this good quality—that they were almost absolutely gas-tight; quite the opposite was then true of clay retorts, which leaked very considerably on account of their porosity, roughness of finish, and the pressure under which they had to be worked. At present, however, these drawbacks to their use no longer exist, and their advantage over cast iron retorts is undisputed. The better class of retorts, which are now on the market, leak but very little—even when new and when carefully managed—their quality in this respect is still further enhanced, becoming almost all that can be desired. Retorts are now manufactured in New York, the surfaces of which are glazed or enamelled, for the purpose of reducing the amount of leakage, but we have not been able to learn with what degree of success.

ADVANTAGES OF CLAY RETORTS.

When using clay retorts greater heats can be attained than with iron retorts; the average temperature for the latter is 1700°F., a cherry heat, and for the former, 2200°F., a bright orange heat; this is a great desideratum since much better results are obtained at this temperature than at any other. The following tabular statement of the results of a series of experiments, made some years ago at the Manhattan Gas Works, will illustrate the advantages of clay over iron retorts.

	Iron.	Clay.
Charge of coal per retort	200	223
Yield of coke in bush. per ton of coal	40	40
Bush. of coke used as fuel per ton of coal.	20	13
Per cent. of coke used as fuel	50	32·5
Yield of gas in cu. ft. per ton of coal	9500	10000

Then, too, it will be perfectly safe to state that the durability of clay retorts is fully twice that of cast iron retorts; the life of an average clay retort ranges from 20–28 months, and the present price varies from $30 to $40, according to the quality; this evidently is considerably less than the cost of a cast iron retort of the same dimensions. In small gas works of two, three; or four retorts, cast iron retorts are still in use; there can be no doubt, on the other hand, that ere long the use of clay retorts will become universal, and their first introduction, indeed, must be looked upon as having been a very important step in the progress of gas manufacture.

Clay retorts were first manufactured in this country in 1858, by the Brooklyn Fire Brick Works; at present their manufacture has become quite an industry, and large works are located not only in New York and vicinity, but also in Philadelphia, Pittsburgh, Baltimore, St. Louis, and, finally, at Perth Amboy, N. J., where an excellent quality of fire clay is found.

The successful use of clay retorts involves several elements, the most important of which are the following: The form and the quality of the retorts, the way in which they are set in their furnaces, and, finally, the mode in which they are managed.

First, then, in regard to the form of the retort as affecting not only its durability, but also its efficiency and its convenience of working. So far as the latter element alone is considered, the form of retort which was at first adopted by Grafton—the rectangular section—was probably the best and at the same time nothing can be said against its efficiency as a gas generator. It was, however, the very worst form for strength—the unequal expansion due to the corners soon weakened it, while it it had the additional disadvantage that the corners were liable to be burn away. Its use, therefore, was soon abandoned in Great Britain. In France, on the other hand, it has been adhered to more faithfully, and French managers are even now using a retort which differs from the original rectangular section in this point only—that the objectionable corners are rounded off.

The next weakest form of retort is that known as the "D," which meets with greater favor than it deserves, being in use in some of the largest works in this vicinity. It is open to the same objections which are urged against the first form of retort and, in addition, is more difficult to "draw," as the operation of removing the coke is called.

As far as strength and durability alone are concerned, there is no doubt that the circular section is preferable to all others; at the same time it must be borne in mind that it is the very worst form for producing gas—the coal cannot be disposed as evenly as in the "D" retort. In point of facility in "drawing," it is again to be preferred, since in it the coke has a tendency to slide towards the center. It is very generally used in Great Britain, but it has never met with the approval of our managers. In selecting a retort, however, it should always be borne in mind, that the more nearly its section approaches the circle, the greater, naturally, is its strength, the less serious are the strains due to the alternate expansions and contractions to which it is subjected, but the less efficient is it in carbonizing the coal.

These considerations, probably, led to the construction of retorts having an elliptical section, thus combining to some extent the good qualities of the circular and "D" sections. In Europe this retort is in

* A Graduating Thesis at the Stevens Institute of Technology.

† American Gas-Light Journal, August 16, 1876, p. 88.

more general use than any other; within the last few years it has been introduced in this country, with great success, particularly in the new works at Pittsburgh, Pa., and Cincinnati, Ohio.

We now come to that form of retort which is almost universally employed in this country, and which, indeed, is eminently American. It is commonly known as the "three-center" retort, and would appear to be a combination of the French and elliptical sections; it may be regarded as the retort which is best adapted to durability, strength, and general efficiency as a gas generator. This form, therefore, will here be adopted—the only modification being that for an equal height it is not quite as flat.

Besides these a very peculiar form of retort is occasionally met with; we refer here to what is known as the "bull head" retort, which probably had its origin in the fact that when larger retorts were being introduced, it was sometimes desirable to use mouth-pieces originally intended for smaller retorts; in order, therefore to accommodate the new arrangement, the retorts were so made that at a distance of about 24 inches from the mouth, they began to contract until the proper dimensions were reached.

A few words now in regard to the usual dimensions of these retorts. In England a very common size for a round retort is 16 inches internal diameter, 9 feet in length, and 2½ inches in thickness; they are sometimes made 18 feet long, open at both ends, and, since they then extend through two furnaces, are called "through" retorts. This retort has been used in a few instances in this country, but it is not regarded very favorably; the only advantage in using it would appear to be the facility with which it can be cleaned out. When elliptical are used, the dimensions are frequently $12'' \times 24$ and $15'' \times 20''$, the length being 10 feet; with the D retort $14'' \times 14''$ and $15'' \times 13''$ are common. In the United States the more common dimensions are $12'' \times 20''$, $13'' \times 24''$, $14'' \times 22''$, and, recently, $14'' \times 26''$; the thickness varies from $2\frac{1}{2}''$ to $3''$, the length from 8 to 9 feet. The dimensions which were adopted in this particular case are as follows—section, $12'' \times 24''$, length over all, 9 ft., thickness, $3''$; there is an additional swell of one inch around the mouthpiece, for the purpose of receiving the mouthpiece bolts.

The quality of the retort, as already hinted, is a serious element in their success. It is not only affected by the quality of the fireclay, but also by the method of manufacture. Among the characteristics of a good retort are homogeneousness and a smooth and hard surface, since it will then better withstand the wear and tear due to the tools used in charging and drawing; it should be well burnt, should have a uniform light brown color, and should emit a clear, ringing sound when struck by the hand.

We will now take up another topic, that of

SETTING THE RETORTS,

the manner of which largely determines their life and their success generally. It is undoubtedly the most important subject which we have to deal with in discussing the manufacture of gas, and the remark made many years ago by an eminent English engineer Beckstone) and so frequently cited since—"on the proper mode of setting the retorts the prosperity of a gas works mainly depends," applies equally wel at the present time.

The retorts are placed horizontally in their furnaces, technically called "ovens" abroad, and "benches" in this country. In the case of small works, it is customary to set them two or three in a bench. In the larger works of several years ago, benches of five retorts were used, arranged in the manner here shown—

the dimensions of the four lower retorts were either $12'' \times 20''$, or $14'' \times 22''$; the highest retort was usually made somewhat larger than the others, $13'' \times 23''$, or $14'' \times 26''$, being exposed to the direct action of the heat. The weight of the upper retort was carried by the two middle retorts by means of a number of "saddle tiles"; the strain thus brought upon them invariably caused the inner sides to bulge out and, more particularly so, since these parts of the retorts were exposed to the highest temperature. The furnace gases in their upward course struck these parts first, and a partial remedy for their rapid destruction was found in the introduction of "shield tiles" to protect these points. It had also been noticed that too much of the heat passed off unutilized: in some cases, therefore, the odd retort in the center was removed, and two retorts, $12'' \times 20''$, or $14'' \times 22''$, were substituted; they were placed at equal distances from the center line, as nearly as possible directly above the remaining four retorts. It must be borne in mind, however, that for the present no change was made in the dimensions of the "skeleton" of the bench, and in the area of the grate; the results attained were, therefore, not as good as were those subsequently with benches in which the necessary alterations were made. In the majority of cases, however, the "skeleton" was rebuilt for the reception of six retorts, and the dimensions of the bench then under went a noticeable change; the interior, width, height and, very often, the depth of the bench were considerably enlarged. Larger retorts could then be introduced, very common sizes being $13'' \times 22''$, $13'' \times 24''$, and $14'' \times 26'' \times 9$ feet long; the brickwork surrounding the bench was somewhat increased, and radiation of heat was more thoroughly intercepted; finally, a further step in the direction of attaining economy in the consumption of fuel was made by reducing the area of grate surface by fully 25%.

These, and a few minor changes, made the gas producing plant more thoroughly efficient in every respect, and the credit of introducing this important improvement into the United States is due to Geo. W. Edge, Esq., Engineer of the Jersey City Gas Works. At present quite a number of benches of 5 retorts are still in use; most of them, however, were built before benches of sixes had been introduced, and there can be no doubt that ultimately they too will be abandoned.

[To be continued.]

North British Association of Gas Managers.

[From Report in "London Journal of Gas-Lighing."]

[Concluded from page 137.]

[PAPER READ BY MR. D. BRUCE PEEBLES.]

The instruments of pressure I have the honor to bring before you to-day are of four different kinds—viz, for stations, districts, houses, and public lamps.

The action of the instrument is as follows:—Water being filled into the proper level, the float comes into action, raising the bell and closing the valve, the size of the float being calculated to do so when the governor is out of action. Gas being turned on, pressure is immediately established above and below the bell; that below being dependent on the initial pressure and the rate of consumption, while the pressure between the case and the top of the bell is regulated by the small governor. By this means, therefore, we can, as it were, load the bell with different gas pressures instead of weights, and great delicacy of action is thus obtained, which must be due to the entire absence of friction in the large governor, the bell of which floats as easily as a cask or a cork does in water, and responds to every change of pressure promptly and accurately. This delicacy would be fatal to it were it not for the valvular arrangement, which is indispensable. In the ordinary governor the valve has always given trouble, because at certain points, especially when a limited supply of gas is passing, there is a great tendency to pulsation or bobbing, the reason of which is that the area of the cone base, particularly when near the closing point, is acted on powerfully by the inlet gas pressure. This addition to the regulated pressure, which is acting on the area of the dome of the bell, gives a tendency to close the valve entirely, which it sometimes does, and when this happens, as consumption still goes on, the gas is drawn away from under the bell, which falls and again opens the valve. The elasticity of the gas promotes this action, which, once being set up, a continuous bobbing or jumping is the consequence, the pulsations or strokes being perfectly isochronous, and having a constant tendency to increase in intensity.

This phenomenon is no doubt perfectly familiar to many here. The more delicate the action of the governor is, the greater likelihood is there of it taking place; and, coming on as it does at most unexpected times, it constitutes a great annoyance not unattended with danger. An accident happened to a governor some years ago, the consequences of which might have been serious had it not been immediately discovered. On examination it was found that the rod to which the valve was attached was broken. There can be little doubt that these pulsations were the cause, the rod having far more strength than necessary to merely suspend the valve. By this new arrangement we see that the pressure is taken entirely off the bottom or cone base of the valve, and all tendency to unsteadiness of action is thus prevented. It can be applied with equal advantage to the ordinary float governor. Mr. Hartley, of London, and Mr. Warner, South Shields, have each devised an ingenious equilibrium arrangement, which obviates the tendency to pulsation. They place a small gasholder in a separate tank, the area of the holder being exactly the same as the area of the cone base of the governor, and so connected and arranged that the inlet pressure acts upon both, the action on the valve being thus neutralized.

Mr. Warner's governor is entirely enclosed, and he adjusts the pressure by a lever attached to a horizontal shaft passing through a stuffing-box.

In the ordinary float governor there has always been a great tendency of the float to leak, which is a serious objection, but we shall have no difficulty in discovering the cause if we consider the large volume of air sealed up, and now and again subjected to changes of temperature. We can see that there must be a continual straining of the joints, as with an increase of temperature there will be a tendency of the float to bulge, while if the temperature decreases there will be a tendency to collapse. Ultimately the jointing will give way, admitting water and destroying the buoyancy. To prevent this, a small ventilating-tube, is carried from the float to the top of the bell, thus relieving the confined air, and the float being made of block tin, we may expect it will be one of the most lasting parts of the instrument.

Instead of the large heavy weights which are necessary for altering the pressure with the ordinary governor, small weights are used, so light that they might be carried in the pocket without inconvenience.

We shall now try the action of the governor with the pressure we have at our command, and note its behavior under different degrees of initial pressure, and also with different rates of consumption. We see that by putting one of these very small weights on the small governor, there is an increase on the outlet pressure, and as weight after weight is added, we notice that the large governor responds with precision and delicacy. Let us now adjust it to a pressure of 1-0 inch, and note its behavior under varying initial pressures and with different rates of consumption, and we observe that the gauge remains steady under all these tests.

Another novelty is that the action of the governor may be controlled, and the pressure altered at a distance from the governor itself. By taking a small tube from any part of the main between the gasholder and the governor, and bringing another tube from the space above the bell, and connecting these with the small governor, the action is quite as certain and complete as when the small governor is close to the large one, so that the manager may have these pipes led into his office, or even into his house, though at a distance from the works, and alter the pressure at any time without rising from his seat.

We come now to the district governor, and by ex-

amining the drawing before us we see that it acts in precisely the same way as the station governor we have just described, and seen in action. Indeed, these dry governors are admirably suited for station governors for small works. The gas enters at 1, passing through the valves, 2, and, acting on the under side of the flexible diaphragm, 3, it tends, in conjunction with the weight, 4, to close the valve; but the inlet gas, passing through the pipe, 5, and the small governor, 6, acts upon the upper side of the diaphragm, 7, tending to open the valves, and according to the degree of pressure to which the small governor is adjusted, so will be the outlet pressure given by the large governor, which never will be exceeded, however much the initial pressure may be increased. This action is exactly the same as that of the station governor; but when we wish to use it as a district governor a stopcock or screw valve, 9, is employed to establish the minimum day pressure. When the day pressure is on at the works, the district day pressure is established by keeping the valve of the small governor entirely open, and out of action, and moving the stopcock or screw-valve, 9, until the desired district day pressure is obtained. The night pressure is then put on at the works, and the small governor, 6, adjusted, by the weights, to give the desired night pressure, which cannot then be exceeded under any circumstances, unless the weights of the small governor be purposely altered. We have thus the command of two district pressures, a maximum and a minimum, dependent on the action of the governor at the works; and it must be understood that the district governor, being automatic, requires no attention after being once set.

We shall now put the district governor in action; and let us suppose that there is a pressure of 0·8 inch wished as the district day pressure, which is to be increased to say 1·8 inch, as the required maximum night pressure, and let the small gasholder we have here be supposed to be the governor at Leith, set, to give a pressure of 2·0 inches at the elevated district where the governor is placed. We now adjust it by the stopcock or screw-valve to give a pressure of 0·8 inch as the day pressure, and so long as the pressure at the works is not increased, the district day pressure will remain the same; but if we increase the initial pressure, the district pressure will also increase; until it comes to the point at which the small governor is set—viz., 1·8 inch, and there, as we see, it remains steady, however much the inlet pressure may be increased.

The house governor is a simple instrument, free from any complex parts which would be liable to go out of order. The peculiarity of the one before us lies in the jointing, and in the employment of animal membrane prepared with glycerine for the diaphragm. There has always been a great objection to the smell given from house governors, on account of the diaphragms leaking through the pores of the leather, This membrane prevents that thoroughly, and also, when combined with leather, adds greatly to the strength of the diaphragm, which, therefore, lasts much longer, and gives no trouble.

These governors are quite sensitive enough for all ordinary purposes, so far as the economical combustion of gas is concerned, the variations on the outlet pressure never exceeding 0·2 inch under extreme variations of the initial pressure or the rate of consumption. Simple in construction, made of lasting materials, easily repaired and most reliable in action, they are giving satisfaction to thousands who now have them in use, and, in conjunction with good burners, the resulting health, economy, and comfort must be incalculable.

It is scarcely necessary to take up time in describing the lamp-governor, the peculiarities of which are now well known. With ordinary lamp-governors there has always been a difficulty in testing and rating them. Indeed, there is no way of adjusting the pressure but by taking them to pieces. They must then be tested, and afterwards refitted, which involves much loss of time and a great deal of trouble. With this governor no refitting is required, as will be readily seen by referring to the drawing, and to the governor before us, which is in section.

It will seen that after rating or adjusting the pressure, the parts never require to be interfered with, as nothing is needed but to press down the brass cap over the governor, and fix it in its place. It will be observed that it differs from all governors of the same class in being made of cast iron, which will not melt in the lamp, as some of these others made of soft metal do. The removal of the brass cap is easily done, and gives ready access to the diaphragm, so that weights may be put on or taken off until any desired pressure is obtained, the burner never having to be taken out of the tube during the operation, and no refitting of the parts being required.

In 1874 Dr. Wallace, of Glasgow, read a paper "On the Economical Combustion of Coal Gas," before the Philosophical Society of that city. Referring to these governors, he said: "Already about 9000 of these have been supplied to the city of Glasgow, and I understand that it is the intention of the authorities to introduce them all over the town, the saving thereby effected I calculate to be about £6000 per annum, without any diminution of light." Since the above was written, another 4000 have been supplied, making in all about 30,000.

Between 70,000 and 80,000 of these house and lamp governors are now in operation, and it is most probable that the use of gas-governors of all kinds will continue to extend as the attention of gas engineers and corporations is being more and more directed to the advantage of maintaining low pressure in the mains, so far as it possibly can be done consistently with a proper supply to consumers, while a movement has been commenced by gas managers, having for its object the education of consumers as to the best method of burning gas, so as to get the full value of the illuminating power at the least expense, and, at the same time, maintain a healthy atmosphere during its combustion.

We have now considered some of the methods and instruments employed for accomplishing these ends, and, in closing, I beg to thank you for your patience and kind attention to what, I am afraid, has been too long a paper, considering the limited time at your disposal to-day.

River Protection at Plattsmouth, Neb.

[A paper read before the Boston Society of Civil Engineers, March 15th, 1876.]

BY THOMAS DOANE, C. E.

The easterly terminus of the Burlington and Missouri River Rail Road in Nebraska is at Plattsmouth on the westerly bank of the Missouri River.

The city of Plattsmouth lies upon and among the bluffs of this river about two miles below the mouth of the Nebraska, or Great Platte River.

This river descends from the west, with a fall of from three to five feet per mile, and discharges the Rocky Mountain waters into the Missouri River, through several mouths. These mouths are very changeable as to location and capacity, and the river is apparently very whimsical as to the particular mouth or mouths which at different times and occasions it selects through which to discharge itself. Its waters are white and at times strikingly in contrast with those of the Great Muddy, and the two waters can be traced for miles before becoming so mixed as to lose their identity.

Freshet time of the Platte River is usually in April, while that of the Missouri, whose sources are much further north in the Rocky Mountains, is in June. If the Platte River in freshet, finds the Missouri at a low stop, it projects its waters entirely across the Missouri; while in cases of local freshets, in which either river may obtain the ascendency, the current takes other courses, and as a consequence keeps the Missouri channels, sand bars, and banks in a very unsettled and unsatisfactory condition for miles below the Plattsmouth.

The station grounds of the rail road lie along the river under the bluffs, between the city of Plattsmouth and the river.

Within ten or twelve years there was a broad meadow bottom extending along in front of the city, having a width from the bluffs of nearly half a mile, but an important change in the Missouri itself, combined with the action of the Platte, has taken this all away, and the river was only restrained by the harder material of which the bluffs are made up.

The Missouri at this point is now from a mile to a mile and a half wide, while the Platte for two hundred miles above its month is from half a mile to a mile wide. In consequence of this washing away of the table lands, and the very crooked condition in which the banks were left, it was found that suitable grounds for the rail road could not be had without reclaiming something from the river, or at least substantially protecting what remained.

The problem was, *how to do it*. The conditions were a ledge of rock in the bluff about two miles *below* the station, a *river* in front having a depth at low water of twenty feet, a current of *four to five miles per hour*, running *straight* against the bank to be protected, and carrying $\frac{1}{4}$ inch of *sand* in a *tumbler full* of its water, equal to one of sand to twelve of water while in freshet.

It was determined to push out boldly into the river, in order both to reach the *hard bottom* of the *river*, and so save being undermined, and to *secure* an even width of grounds between the river and the bluffs, thus accomodating several parallel rail-road tracks. The line desired was first laid out and soundings were taken along it, giving an extreme depth of twenty feet without material variation. A part of the line was a regular curve, and a part straight.

A steamboat and a couple of 120-ton barges were bought. Upon the boat a pile-driving machine was set up, and along the located line piles were driven at a distance of ninety feet apart, this being the length of the straight sides of the barges. The quarry men were then set at work and large loads of stone were towed from the quarry to the place where the piles were driven. The barges were moored to the piles and the stone were discharged into the water. This was repeated till the stone just appeared at the surface of the water. The piles were all numbered and a record of stone discharged between two adjoining piles was kept, through the whole length of the work. Every other space between the piles was omitted in discharging stone, that is only one half the spaces, and consequently only one half the whole length was filled with stone. The numbering of the piles was necessary, not only to determine the amount of stone put in between any two piles, but to ensure the moving out of stone in the spaces not to be filled.

All this work was done in the spring, and before the occurrence of the June freshet in the Missouri.

It was expected that the heavy current of the river would be restrained by the winrows of stone lying along in line, and that the water running inside between the stone and the banks of the river, would be so retarded as to deposit a considerable portion of their load of sand. The freshet of course overtopped the stone which only reached up to low water level, and so continually provided other waters to dump their new loads of sand. So the work went on perpetually day and night, seven days in the week. After a month or two the freshet subsided, and the whole space *behind the stone*, and up to a *level* with the top of the stones, and also out to a slope in the intervals, even with outer slopes of the winrows, and among the stone too, was found well and honestly puddled full and tight with sand. The common freshet-height of the Platte River is but about 4 feet, and it rarely overtops its banks, the great fall in the river making it impossible. That of the Missouri River is about ten feet, while its great freshets reach twenty feet.

Having accomplished so much by the help of the boat and the river it now became necessary to abandon the boats and barges which could not work in freshet times and which could not well elevate stone above low water level. A rail road track was now laid upon the sand, and a narrow embankment was raised up to near high water of common freshets.

The outside of this was then covered three or four feet thick with stone, having the outer face on the same slope with the stone before discharged into the water, and wherever the slopes in the intervals between the original winrows would take stone they were covered so as to make a uniform face upon the river side. The work was then subjected to another freshet, and all was then filled benind the stone up to its top with river sand.

The economies of this process are the following: While an attempt to fill into the river with earth and then to face with stone would have been entirely unsuccessful, because the earth would be carried away as fast as put in, this process secured the whole of the filling without cost except of time, and of this only about fifteen months.

If an embankment of stone had first been raised to high water mark, the depth at low water being twenty feet, and freshet height ten feet more, with slopes of one and a half to one, there would have been consumed fifty cubic yards of stone per linear foot. By this process the *maximum* quantity of stone used was but twenty-four cubic yards per linear foot. And by filling with stone for only one-half of the total length, the *average quantity* of stone used was but twelve cubic yards per linear foot.

The natural banks of a river, having a height of thirty feet from the bottom, may be rip-rapped seven feet thick with about eight cubic yards of stone per linear foot, which is a saving of but one-third of the above. The advantages of the process which has been described, over the rip-rapping process, are that land can be reclaimed from the river by the first process, while it cannot under the second.

That the meanderings of the river bank, giving increased length to rip rap, can be reduced to such shapes and lines as may be desired for convenient and economical use.

That the work thus becomes permanent, because much less liable to undermine, and much more sightly because irregularity is reduced to regular curves and to straight lines.

In doing the work above described, it became necessary of course to join the winrows of stone at the upper end to the river bank, in order to prevent a draught of water down behind the stone, for then there would have been no depositing of sand. It is very possible that longer intervals between the winrows of stone might have been left, especially in that part which was straight. To fill every third space would probably have been sufficient in that case.

The distance filled in this case had a length of about half a mile, and a width of from twenty to one hundred feet. The upper half of the length was on a two-degree curve about, and the lower part was straight. It was intended to make a future extension by going further into the river, and around a heavy concave bend in the river, and the lines were laid with reference to this. It is not uncommon to call in the aid of such a river to fill behind stone embankments previously made, but it is not known that intervals have been left in the stone embankments whereby as good work is secured at a great saving of cost.

To calculate how fast such work can be filled with sand, when the river runs five miles an hour, and a tumbler full of surface water carries one-quarter inch of sand, would be a difficult problem to solve, but when such water so laden, loses a portion of its velocity, the filling goes on with remarkable rapidity.—*Van Nostrand's Magazine.*

The Importance of a Knowledge of the Laws of Health.

BY THOMAS BOND, F.R.C.S., M.B., AND B.S., LOND., Assistant-Surgeon to Westminster Hospital, and Lecturer on Medical Jurisprudence.

1. On an average, one-half of the number of outpatients treated by a hospital surgeon suffer from diseases due primarily to a want of knowledge of the laws of health and cleanliness. The ignorance of hygienic laws, which affects so disastrously the health of the rich as well as the poor, exists chiefly in regard to dress, ablution and ventilation. This statement may, at first, appear startling, but an enumeration of the diseases that can be constantly traced to the above causes will show upon how sound a basis the statement rests. The following are examples: * * * * * * * * * * The most frequent and flagrant cause of obstruction is the ordinary elastic garter. Children should never wear them at all, as the stockings can be perfectly well kept up by attachment of elastic straps to the waistband. If garters are worn, it is important to know how to apply them with the least risk of harm. At the bend of the knee the superficial veins of the leg unite, and go deeply into the under part of the thigh beneath the ham-string tendons. Thus a ligature below the knee obstructs all the superficial veins, but if the constriction is above, the ham-string tendons keep the pressure off the veins which return the blood from the legs; unfortunately most people, in ignorance of the above facts apply the garter below the knee. Again, in nine out of ten laboring men, we find a piece of cord or a buckled strap tightly applied below the knee, for what reason I could never learn. Elastic bands are the most injurious. They follow the movements of the muscles, and never relax their pressure on the veins. Non-elastic bands during muscular exertion become considerably relaxed at intervals, and allow a freer circulation of the blood.

2. The habit of tight lacing again predisposes to varicose veins, in consequence of the abdominal viscera being pushed downwards into the pelvis, causing undue pressure on the veins of the lower extremities when they enter the pelvis. Physicians also have reported numerous cases of heart and lung disease caused by this pernicious habit.

3. The use of dress is often misunderstood: most persons evidently study and practice it with regard to appearance, or only to keep out wet and cold. The hygienic use of clothes however, is not so much to keep cold out as to keep heat in. The mistake is often made, of taking great care to put on extra wraps and coats when preparing for out-door exercise. This is not at all necessary in robust persons. Sufficient heat to prevent all risk of chill is generated in the body by exercise. The care should be taken to retain sufficient clothing after exercise, and when at rest, to prevent the heat passing out of the body. Indeed, persons very often catch chills from throwing off extaa clothing after exercise, or from sitting about in garments, the material of which is not adapted to prevent she radiation of heat from the body. Linen and cotton underclothing, when moistened by perspiration, parts with heat very rapidly, whereas flannel and silk, being non-conductors, prevent the rapid loss of heat.

4. The most recent offence against the laws of health is the habit of wearing false hair. The perspiration of the scalp is prevented by the thick covering from evaporating, thereby causing a sudden and weakened condition of the skin which predisposes to baldness and other diseases of the scalp. Again it produces headache and confusion of the intellectual faculties. We all know what a relief it is during hard mental work, simply to raise one's hair by running the fingers through it. I should think literary ladies either do not wear false hair or take it off when at work.

5. Ablution is another subject of paramount importance to health. Mr. Urquhart, the introducer of the Turkish bath into this country, is one of the benefactors of the age, and it is to be hoped some day there will be a bath in every town and village in England. Doctors are very much to be blamed for allowing themselves to be prejudiced against it. The usual opinion given by medical men to their patients is that it is debilitating, and only to be borne by the robust. The reverse is really the case; it is stimulating and strengthening, it is a preventive as well as curative in disease. The effect of the Turkish bath on the skin is to cause an active conditton of its functions of elimination, by removing the hardened epthelial scales, by removing the fat from the pores, and by causing the sweat glands to maintain the activity of their functions, giving a general stimulus to the vital power of the skin. Again, it keeps the body in a state of perfect cleanliness, which is so essential to robust health, but these are not its only virtues, it promotes purity of mind and morals. The man who is accustomed to be physically clean, shrinks instinctively from all contact with uncleanliness.

* * * * * * * * *

8. Many persons complain of always getting up tired in the morning. This is very often due to defective ventilation of the bedroom, or from using an undue amount of bed-clothes and bedding. Feather beds are too soft and yielding, and partially envelope the sleeper, thus producing profuse perspirations. The habit of lying too much under blankets is also very pernicious, by reason of the carbonic acid exhaled by the sleeper being respired. Again, it is a common error to suppose, that by simply opening a window a little at the top a room can be ventilated—people forget that for proper ventilation there must be an inlet and outlet for the air. In bedrooms there is often neither, and if there is a fire-place it is generally closed up. Again, it is a mistake to suppose that foul air goes to the top of a room. Certainly the heated air goes to the top, but the chief impurity, the carbonic acid, falls to the bottom. There is nothing so efficacious in removing the lower strata of air as the ordinary open fire-place, especially if there is a fire burning. The usual defect in ventilation is the want of a proper inlet for the air. If the window be open the cold air being heavier pours down into the room, causing draughts, if the door be open, or ajar, the same thing occurs. The perfection of ventilation may be obtained in any room with a fire-place by simply providing proper inlets for the air, and nothing answers so well for the purpose as the upright tubes invented by Mr. Tobin. By this means the heavier external atmosphere ascends vertically through the tubes like the jet of a fountain, displacing the warmer and lighter atmosphere of the room, which finds its exit up the chimney. The tubes should communicate with the outer air on a level with the floor, and should be carried vertically upwards in the room for about four or five feet. A constant supply of fresh air is thus ensured without the slightest liability to draught, as the current goes directly upwards till it strikes the ceiling. It is then diffused downwards, mixed with the heated air of the ceiling. The same principle can be carried out in any room with a sash window, by cutting out two or three holes an inch wide and three inches long in the woodwork of the upper sash where it joins the lower one. The columns of air ascend directly upwards, just inside the window, and mix with the heated air in the upper part of the room. If this system were universally carried out, we should hear less of rheumatism and chills caught by sitting in draughts.

9. Persons should cultivate the faculty of detecting sewer gas in houses. Typhoid fever is often caused by the escape of this gas into the house through defect of the traps and drains. However bad the drains may be outside the house, there is little to fear, provided the gas can escape externally. The following two very simple precautions would naturally diminish the cases of typhoid fever; first every main drain should have a ventilating pipe carried from it, directly outside the house to the top of the highest chimney. Secondly, the soil pipe inside the house should be carried up through the roof, and be open at the top. —*Journal Society of Arts,*

Saving the Gas.—The idea of saving gas is getting to be little less than a mania with some of our city officials.

"What are you coming home at this hour for?' asked the wife of one, as he came stumbling in at six o'clock, the morning after the great Carl Schurtz torchlight reception.

"Caush, my dear," was his naive reply, "I di'n' want to come in the ni', but wait 'til morn,' ter save 'er gas, you shee."

She couldn't see it in that light, and told him so as she led him into the house by the ear.—*Chicago Journal.*

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—Ed.

Letter from Mr. Kidder.

47 India Street, Boston, Mass.,
September, 1876.

Mr. Editor: The article in your issue of 2nd September, from Mr. Rankin, of Louisville, is right, in that it is full of dissatisfaction with the present wasteful process pursued almost universally in the manufacture of gas. He is also right in the proposition to distil the coal in large chambers at a low heat, and subsequently convert those vapors into gas in retorts at a higher temperature; at this point, however, an important factor is obtained, to wit, non-luminant gas as made by the decomposition of steam in contact with incandescent carbon.

The presumption that much more light may be obtained from coal than now is, while the non luminant ingredient of the finished gas is obtained by decomposing a very large per cent of the luminant hydrocarbon oils of the coal, is a mistake.

It is a matter of no practical importance when this decomposition occurs, or where, if it must needs be; but here is the point for correction, here is the waste, here the destruction of illuminating value, and until other resource be sought for the non-luminant element than this destructive one, it will be useless to talk of forms and theories of economy, for there can be no one plan so much better than another, as to warrant any considerable expenditure in the change. What would result by the plan proposed by Mr. Rankin?

His primary retorts where the coal is distilled at a low temperature would produce very little gas, because the temperature is so low, and therefore the product would be chiefly hydrocarbon oils in form of vapor and mostly condensable. These vapors, however, are to be conducted into secondary retorts, which are maintained at a much higher temperature. What for? To convert them into gas is the answer many would give, but that is hardly satisfactory. Is it not, more concisely speaking, to decompose these vapors, to analyze them crudely and separate some of the elementary matter contained in the hydrocarbon vapors in order to obtain a commercial product? And what is that, which being removed will effect this purpose? Nothing but carbon. Is this such a worthless substance that we may treat it with indifference?

Raise the temperature of your secondary retort a little higher and remove the balance of the account, and what is the illuminating value of a ton of coal? Moreover, where would this carbon be deposited? Would it not prove a great practical inconvenience? Ask of Lowe and Kirkhard's patent, 1839, or Saloman, 1855, or Elmar, for they have all had some experience in the matter. The investigations of Mr. Young, of Scotland, recently reported through your Journal, 3rd July, 1876, points most clearly to the way in which, not only the greatest illuminating value may be obtained from coal, but the only way in which the value can ever be determined. All other experiments with this end in view are idle and vain.

I need not here repeat his words, as I trust all gas engineers who have not carefully read the article will do so without fail, as it is of rare excellence in the instruction which it contains, though he does not yet see the way clearly to abandon old retorts, or the destructive method heretofore and even now pursued. Yet the amazing contrast of results by the different treatment of a gallon of the hydrocarbons from coal, showing by the destructive process an illuminating value equal to but 6lbs. sperm oil, while its least value when combined as vapor with "water gas" is more than equal to 25lbs. sperm, and may exceed 50lbs.

These are facts and can they be considered unimportant? When these suggestion are adopted in practice, then will there appear some relation between the quantity of oil contained in the coal and the value of the light obtainable from it, we need hear no more of wasting or destruction, no more demands from the consumer for cheaper gas, and the business may be increased many fold. M. W. Kidder. M. D.

The Lowe Process.

New York, Sept. 13th, 1876.

Mr. Editor: It may interest your readers to hear that the Lowe process, like a healthful phœnix, having been burnt out at Utica, has reappeared at Philadelphia, with every promise of living and doing well. It began operations at the Manayunk station in that city August 5th, since which date it has supplied all the gas required in that division, and has developed some quite interesting facts during that brief time.

The facility of generation, always one of its distinguishing characteristics, has shown here a further increase, as high as 13,400 cubic feet having been obtained from a single run of forty minutes on one generator. This is in part to be credited to the high temperature at which steam is introduced, it being superheated by means of the products of combustion. There is no reason to doubt that with a total of four men on the shift, the three generators at Manayunk would furnish half a million feet per day. The gas maintains its reputation for purity and power, and gives general satisfaction to consumers, although subjected not only to mechanical and chemical tests, but to the active hostility to be expected against any new process. It has of late been passing through the stage in which it dissolves, absorbs, and carries forward to the burner, the deposit which during many years has accumulated in the pipes. This is always accompanied by annoyance, but experience proves it to be only a temporary matter, soon to disappear, leaving the pipes thoroughly cleansed, and allowing the new gas thenceforth to distribute its beautiful light without any drawbacks.

As many of your readers are doubtless visiting the Centennial in these pleasant days, I would extend to them a cordial invitation to examine the working of the process for themselves. Any information they may desire concerning it, can be obtained of S. A. Stevens & Co., at 430 Walnut street, Philadelphia, who will be happy to extend every facility.

Respectfully yours,
George S. Dwight.

Chemical and Scientific Repertory.

Cement.—A good coating for outside brickwork is made by mixing twenty parts clean river sand, one part quicklime, and sufficient linseed oil to form a thin paste. This is also useful as a cement for broken stone, as when dry it becomes exceedingly hard.—*Amer. Architect and Building News.*

Meat Supply.—A report from Smithfield states that the importation of meat from New York, by the freezing process described in the Journal for February 25th, has been successfully continued during the summer, even through the recent hot weather. On Tuesday last, the 22nd August, as much as 1,500 quarters were sold at fair prices. The importers expect a largely increased supply during the coming winter.—*Jour. Society of Arts.*

How to Bleach a Sponge.—A sponge may be bleached almost snow white by the following process: Soak the sponge in dilute muriatic acid for twelve hours, wash well with water to remove the lime, then immerse it in a solution of hyposulphate of soda, to which dilute muriatic acid has been added a moment before. After it is bleached sufficiently, remove it, wash it again and dry it.—*Western Manufacturer.*

A New Test Color.—The flowers of the violet and iris have recently been found to yield a very fine blue color, which is a more delicate test for acids and alkalies than the solution of litmus commonly employed. The name of the new color is phyllocyanin. It will probably before long find its way into all chemical laboratories.—*Ibid.*

Hygeia.—It appears that Dr. Richardson's ideal "City of Hygeia," as suggested in his address delivered before the Sanitary Section of the Social Science Association, is about to take actual form. It is understood that an association has been formed, and an estate purchased on the Sussex coast, for building houses of a superior character, and on the most approved principles, so as to secure as far as practically is possible all the advantages so eloquently depicted by Dr. Richardson in describing his model city of health.—*Ibid.*

A New System of Plastering.—Builders, owners, and tenants of city houses, will doubtless view with interest a new system of plastering, which is claimed to prevent the sudden and disastrous downfall of ceilings so frequently occasioned by defects in the water pipes and consequent leakage and overflow. The invention consists in replacing the scratch coat and brown coat used in ordinary work by the combination of fibro ligneous sheets with a cement composed of lime, sand, and plaster. The sheets are of a fabric resembling coarse bagging, which is secured to the lathing, and the cement is supplied in the ordinary way. A hard finish coating completes the work.—*Amer. Manufacturer and Iron World.*

Light-House at Ceylon.—The stone for the lighthouse on Great and Little Basses Rocks, Ceylon, was cut and fitted in England, and then transported to Ceylon. A noticeable fact connected with the erection of the lighthouse was, that the steam power o the vessel that carried the stone was used to lift the blocks to their places; and that the stones were re-f moved from the vessel to the rocks through the water, in order that the buoyant force of the water, affecting the specific gravity of the stone, might lighten the labor.—*Amer. Architect and Building News.*

The Nickel Ore of New Caledonia, or Garnierite.—M. J. Garnier.—The nickel ores of New Caledonia are not arsenico-sulphides like those hitherto utilised, but silicates of nickel and magnesia. The ore is found amidst the masses of serpentine very abundant in certain parts of the island, and associated with euphodites, diorites, amphibolites, etc. The nickel is accompanied by iron, chrome, and cobalt; these metals, especially the two former, are of an unexampled abundance. The cobalt is associated with manganese.—*Chemical News.*

Accidents on Railroads.—Accidents have occurred on railroads from the engineer confusing the colors of the lights on trains in front. Dr. Favre, of Marseilles, calls attention to the fact, that while in reference to railway employees the recognition of the red signal is almost the only absolutely essential point, with regard to sailors the green is just as indispensable as the red. At recent examinations of 1,050 candidates for employment on railways he detected as many as 98 color-blind, who were deceived as regards one or more colors; this occurring as regarded violet 78 times, blue 50, green 54, yellow 14, and red 10. Of the 98, 29 only hesitated, and 8 corrected their errors, leaving, therefore, 61 color-blind. Ultimately, only 11 had to be absolutely excluded; but if these men had to be examined for sea or coast service, all those who could not distinguish green should have been excluded also.—*Amer. Exchange and Review.*

Gas-Light Intelligence.

United States.

Poor Gas.—The gas furnished by the Citizens Gas Light Company was of a very poor quality last night; in fact it has been so for the past two or three nights. The cause of it we did not learn. There seems to be a good pressure, but no light in it.—*Poughkeepsie Daily Eagle, Sep.* 18.

Sanitary Drainage.*

We hail with satisfaction a growing uneasiness concerning the disagreeable questions of sewerage, which such books as the one now before us are eminently calculated to strengthen and extend. The substance of this work appeared in a series of articles which were published in the *Atlantic Monthly* during last year, and which attracted a good deal of attention. The subject is unsavory as well as disturbing; but Mr. Waring has here treated it out of an experience and knowledge, and with a command of facts, which should make his book of great practical service to individual builders and to the community. There is perhaps no one department of the building-art, which has by common consent remained so entirely in the hands of the average builder, unscientific, empirical, dogmatic, and bigoted, and which has been so little governed by the plans and specifications or the personal supervision of the architect, as this most important and most difficult matter of drainage, as there is none in which the practical man, so called, has more to learn; and this at the same time that both architect and builder continue to give their languid assent to the proposition that no portion of the builder's work requires more urgently that it should be done with the best knowledge and skill and the most faithful supervision. The journeyman mason has laid the drains; the journeyman plumber has run the pipes; the journeyman carpenter has followed, and covered them up away from the incurious eyes of the easy owner, who knows his house is furnished with all the modern improvements at a sufficiently high cost, and who rests content in the assurance of safety, while sewer and drain and soil-pipe and trap deliver, with noiseless promptness, the seeds of disease and death from households and shops and factories miles away, through every story of his first-class dwelling.

The occasional notes of warning raised from time to time during the prevalence of epidemics, or when disordered sewers have exaggerated the offensiveness of their contents, have nearly failed of any practical result; and the only variation in the devices of plumbing and drainage in use a generation ago, which tends to mitigate the evils under which we willingly suffer, is the custom, only now becoming general, of ventilating the soil and waste pipes. This is of itself an immense safeguard, and, if it could be made universal wherever water-closets and set basins are in use, would go far in reducing the danger which now attends these modern contrivances. A perfectly intelligent system, however, would not stop here, but would review every step of the sewage route, from the point where the waste is first discharged to the place of its final deposit. The ventilation of the private soil-pipe must be followed by that of the sewer itself. By this step two advantages are secured. First, a current of fresh air flowing through the sewer dilutes the poisonous gases there generated, and renders them inocuous. Second, the free communication between the sewer and the outside air prevents the sucking out or forcing of the water from the traps of private waste and soil pipes in connection with the sewer, which is constantly liable to occur from the changing pressure upon the confined air, caused by the rise of the tide, a strong wind blowing upon or across the sewer-mouth, the flushing of the sewer during heavy rains, and by various other probable contingencies. "Typhoid fever is said to be rarely absent from towns with unventilated sewers."

Mr. Waring urges the abolition of private cesspools; contending that the health of the community would be less endangered, if the house-drainage were allowed to flow in the gutters of the streets, exposed to the diluting action of the atmosphere, than now, when it is permitted to soak into the soil from which the water of house wells proceeds, and to accumulate "in unventilated and leaky caverns, whence the poisonous gases, sure to be produced, find their way through the drains into our houses or into their immediate vicinity. * * * The one thing that should never be allowed in a village, and which should even be regarded with great caution in the case of an isolated house, is the ordinary leading cesspool."

The use of the public sewers of a town by great rendering-works, slaughter-houses, and similar establishments is deprecated; the writer suggesting not unreasonably that the community "should be compelled to construct sewers only for the removal of such waste matters as are incident to the daily life of all classes of the population. If breweries, chemical works, and other manufactories producing a large amount of liquid waste, are to be provided with a means of outlet, this should be done entirely at their own charge, their profit and convenience should not be advanced at the cost of every member of the community. And, more than this, the wastes of factories being often pernicious, not only on reaching the outlet of the sewer, but by the generation of gases within them, which may pervade all their ramifications, it is a serious question whether such establishments should not be compelled to secure independent outlets at their own expense, or at least to render their wastes inocuous before discharging them into the public drain, paying even then an extra sewer-rate proportionate to the extra service they require."

Furthermore, since the best system of sewerage depends for its efficiency and safety on the intelligence and thoroughness with which it is executed, it becomes a matter of importance that private drains as well as the public sewers should be laid under the supervision of the public officer who has the supervision of the latter. The best municipal systems recently executed make this obligatory on all builders. One of the printed regulations adopted by the city of Providence in the works now being carried on, runs as follows: "No one but a drain-layer duly licensed by the water-commissioners will be allowed to make connections with the public sewers named in the above section, or to lay any drains in connection therewith."—*Amer. Architect and Building News.*

* The Sanitary Drainage of Houses and Towns. By Geo. E. Waring, Jun. Hurd & Houghton, Publishers, New York.

New Gas Lighthouse on the South Coast of Ireland.

This lighthouse lantern, which is one of the largest that has ever yet been constructed for use in the British dominions, is about thirty feet high, and consists of a base or lightroom, eight feet high, formed of sixteen cast iron plates joined together, the edges of each being planed so as to form one solid block, and lined on the inside with panelled mahogany. Round the inside and at the top of this lightroom is a cast-iron gallery, access to which is obtained by a flight of wrought-iron stairs with handrail. Springing from the level of this gallery, and surrounded on the outside by another gallery, is the frame, about twelve feet high, composed of wrought-iron upright bars to which are bolted cross-bars or astragals composed of malleable iron. Both the upright bars and the astragals are faced with copper slips. In these sashes, on the side facing the sea, are placed plates of best polished glass, and on the other side galvanized sheets. Surmounting this frame are the dome and cowl, composed entirely of copper.

In the base of the lantern is placed the clockwork machinery, enclosed in a cast-iron frame, above which is a cast-iron revolving carriage working on gun-metal rollers. The frame is caused to revolve, and is kept in motion by the clockwork above referred to. On this is placed the octagonal frame which supports the lenses. The lenticular apparatus is constructed so that there may be four tiers of eight lenses each. The lenses are first-order annular, and are intended to revolve round the burners at the rate of one entire revolution every eight minutes, so that a beam of light is transmitted to the observer every minute.

There are four burners—Wigham's patent—one above the other, each placed so as to be in the focus of each of the lenses on its level, and so constructed that the heat of each causes more perfect combustion in the whole. Each burner contains 108 jets, but is so constituted as to form burners of 28, 48, 68, 83 and 108 jets respectively, by the removal or addition of rings of jets, each of which can be removed or added in a moment.

The light to be exhibited is "Wigham's group-flashing light." The beam of light which is transmitted every minute from each of the lenses, is broken up into a succession of six or eight rapid flashes, followed by an interval of darkness. This is accomplished by means of wheelwork attached to the clockwork machinery which revolves the lenticular apparatus, by which the gas is alternately shut off and on. It is evident that in the periods of darkness when the gas is shut off it is economised. This is not the case in ordinary flashing oil lights; for when oil is used the flash is produced by interposing shades, the oil lamp burning whether the light is visible or not.

The illuminating power which this lantern is capable of encasing is very great; the illuminating power of each of the gas burners when at its maximum strength being equal to 2,923 sperm candles. When four are lighted, the light is therefore equal to 11,692 sperm candles. When this light is increased, as it is to an enormous extent by the interposition of the lenses, the effect to the observer will be something exceedingly splendid. The electric light, which has been hitherto considered the most powerful that can be applied to light-house purposes, falls very far short of this light in illuminating power. (The highest power yet reported upon—Gramm's Double Power—being equal to but 6182 candles.) The use of gas for such lights has the great advantage of extreme simplicity: any ordinary light-keeper can increase or reduce the power of the light with the greatest facility, and no expensive or intricate machinery is required either to produce the gas or to maintain the light. Perhaps, however, the most obvious advantage which arises from the use of gas for lighthouse purposes is that, while a burner consuming but 51 cubic feet per hour and producing a light equal to 429 sperm candles is sufficient to send its ray to the horizon in clear weather, a light-keeper is enabled to increase the light by such stages as the thickening weather may require, till it reaches a consumption of 1232 feet per hour, with the effect in illuminating power of 11,692 candles, which it is anticipated will produce a light which can be seen by the mariner in thick fogs. As the cost of gas, even at outlying stations, is seldom more than 10s. per 1000 cubic feet, this would make the expense for clear weather light only about 6d. per hour. The large fog light is, of course, more expensive, but then its benefit to shipping, by increased security to navigation, may be incalculably great.—*Journal of Gas-Lighting.*

Natural Gas for Heating Purposes.—Experiments in the use of natural gas for heating purposes far removed from the well, show that the pressure is much reduced by conducting it any great distance. In puddling with this gas at Etna Borough, 19 miles from the well, the pressure was reduced from 80 pounds at the well to 17 pounds at the furnace. Analyses of the gas showed the presence of large quantities of marsh gas, and it was found that the furnace worked more satisfactorily by the use of a little coal in connection with the gas. A special furnace was found necessary, the gas and air being heated before burning. It was estimated that 4000 cubic feet of gas at one pound pressure were required to puddle a ton of iron. The failure of the apparatus to thoroughly mix the air and the heavy gases, to burn them to carbonic acid, resulted in the production of iron containing an unusually large per cent of phosphorus. With the Robertson gas furnace a better result was effected, although the amount of phosphorous in the finished iron was 0.36 per cent. Natural gas in Pennsylvania contains varying proportions of free hydrogen, the specific gravity changing accordingly, and in those wells which give out gas freely the pressure changes during the day, being greatest about 9 A. M. and 4 P. M. Additional wells affect those already in use.—*Amer. Exchange and Review.*

Two hundred and fifty-six thousand barrels of petroleum have been destroyed by lightning in Pennsylvania since April 12th.—*Boston Post.*

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

THIS IS A RECOGNIZED OFFICIAL ORGAN OF—
LIGHT, HEAT, MINING INTERESTS, STEAM, WATER-SUPPLY, PATENTED INVENTIONS, VENTILATION, SANITARY IMPOVEMENT, AND GENERAL CHEMICAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS

NEW YORK—AMERICAN NEWS COMPANY, 119 and 121 Nassau St
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—COE, WETHERILL & Co., Ledger Buildings, Phila.
Germany—B. WESTERMANN & Co., of New York.

MONDAY, OCTOBER 2, 1876.

Report of the Committee of Science and the Arts on the Dioptric Light of General M. C. Meigs.

HALL OF THE FRANKLIN INSTITUTE,
PHILADELPHIA, September, 1875.

The sub-committee of the Committee of Science and the Arts, constituted by the Franklyn Institute of the State of Pennsylvania, to whom was referred for examination the improved 'Dioptric or Water-light,' invented and patented by Gen. M. C. Meigs, U. S. Army, report that they have examined the same, and consider the arrangement of the bracket tubing with a swing joint adapted to the curve of the glass water globe, and through which the gas passes to the burner, as very meritorious; thereby securing such movement of the burner around the globe, as to enable the concentrated rays of light to be thrown upon any desired spot, or limited area of space.

The use of glass globes, or bowls filled with water as condensers of light, has long been practiced by mechanics, artisans, and others, but generally in very crude portable forms. The patented combination of its use in this instance is so very neatly and permanently adapted to any of the present styles of illumination, that its introduction to a great variety of purposes, would seem to be secured thereby:

The glass globe being an enclosed one, with the exception of a small filled hole at the top, renders the fluid not subject to any agitation, or the admission of any dust or other impurities, which would materially affect the transmission of the refracted rays of light passing through the water; as also retaining its transparency, preventing much evaporation, and keeping it serviceable for months, without replenishing. In these respects it is greatly superior to the "water bowl," which rapidly accumulates dust, and is subject to disturbances of the fluid, by currents of air passing over it. For a comparison of its light, *with* and without the glass globe, a very careful test was made on a "Bunsen Photometer" of 100° scale made by the American meter company. The test was made with the fish-tail burner furnished with the bracket, consuming *five cubic feet of gas per hour*, at a pressure of *nine-tenths of an inch* column of water—and the same *elements* existing during the whole time of the test. The results are as follows, and expressed in standard candles, consuming one hundred and twenty grains of sperm per hour. With the globe attached the light concentrated upon the screen of the photometer gave a result of 90.75 candles, in the center of a field of illumination of 3 or 4 feet diameter—*without the globe attached*, the light from the same burner, gave a result of 16 candles upon the screen or photometer. It must be remarked in explanation that the light of the area of said illuminated field, is restricted to the focal dimensions, due to the diameter of the globe; and was not diffused throughout the apartment, as was the case during the tests without the globe. It is therefore to be distinctly understood that, for all the purposes to which this invention may be applied, such as reading, writing, drawing, engraving, etc., etc., the strength of light is materially increased only within the concentrated rays of the globe condenser. As a basis of economy, taking the quantity of gas consumed as five cubic feet per hour, and equal to 16 candles, giving a reasonably satisfactory light to whole apartment, *without the globe*—and *with the globe* we have the same quantity of gas consumed per hour and a light concentrated upon an area of 2 square feet of 90.75 candles, or 28.35 cubic feet of gas per hour.

MEMORANDA OF TEST.

	With Globe.	Without Globe.
Gas consumed per hour...	5. c. ft.	5. c. ft.
Pressure of gas.....	.9 inches.	.9 inches.
Distance gas from screen...	90.5 "	80. "
" candle " ...	9.5 "	20. "

For the intensity of light, the photometric formula is: As the squares of the respective distances—

With Globe. Without Globe.

$\frac{2)90.5}{9.5} = \frac{8190.25}{90.25} = 90.75$ $\frac{2)80}{20} = \frac{6400}{400} = 16$ c'd's

Respectfully submitted,

(Signed) HENRY CARTWRIGHT, Chairman.
SAMUEL SARTAIN,
JOSEPH ZENTMAYER,
Sub-Committee.

—*Jour. Franklin Inst.*]

New Galvanic Battery.

M. Leclanche has just constructed a new galvanic battery, which the *Annales Industrielles* thinks likely to render great service both in manufacture and in scientific research.

The original oxide of manganese battery by the same inventor consists of a porous jar filled with *pyrolucite*, in which is contained the carbon forming the positive pole. This jar is immersed in a solution of sal ammoniac in contact with zinc. M. Leclanche has, however, introduced several improvements into this battery. He has superseded the porous jar by conglomerating the oxide of manganese, mixed in nearly equal parts with carbon, but with the addition of a small quantity (5 per cent.) of resin for the purpose of giving consistency to the mass. These three substances, properly pulverized and intimately mixed, are conglomerated under a considerable pressure, and at a temperature of about 700° Cent. (312° Fahr.) into a solid cylinder, which serves at the same time as a porous diaphragm and a positive electrode. But here a difficulty occurred. Under the influence of the current, an almost insoluble oxychloride of zinc was formed, which was deposited in a crystalline form in the pores of the electrode, and considerably diminished its conductibility, so that the internal resistance of the battery increased very rapidly, occasioning considerable inconvenience, especially when used for telegraphic purposes.

M. Leclanche has now got rid of the difficulty by inserting in the centre of the carbon and manganese electrode, while being moulded, a small cylinder of bisulphate of soda. This acid salt prevents the formation of the oxychlorate of zinc; and the battery preserves its regularity for more than a year without the necessity for renewing the water of the saline solution. It offers a much slighter resistance than other batteries, and gives out a considerable quantity of electricity. A single element of small size, presented by M. Du Moncel to the Academie, immediately caused a platinum wire connecting its two poles to become red hot.—*Jour. Society of Arts.*

Price of Gas.

The following prices are *official*, having been furnished to the AMERICAN GAS-LIGHT JOURNAL by the officers of the various Gas Companies.

Albany (Peoples) N. Y.	$2.75	
Annapolis, Md.	3.40	
Atchison, Kansas.	4.50	
Austin, Texas.	6.00	
Allegheny City, Pa.	1.80	20 p. ct. off prompt pay
Albany, N. Y.	2.75	
Ashland, Ohio.	3.50	Street lamps 4½ hours 17 nights per month $15 per annum.
Augusta, Ga.	4.00	Net.
Anderson, Ind.	3.50	Crude petroleum.
Ashtabula, Ohio.	2.00	Wren's process: $10 for 80 candle gas.
Auburn, N Y.	3.50	5 p c off prompt pay.
Allentown, Pa.	2.50	$18 per an street lamps Meter rent 10 cents per month.
Ashland, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Brooklyn, B'klyn.	2.50	
Brooklyn, Citizens.	2.25	
" Nassau.	2.75	
" Metropol'an	2.50	
" Peoples.	2.75	
" W'msburgh	2.75	
Brockton, Mass.	3.80	
Batavia, N: Y.	3.00	
Bridgton, N. J.	3.50	
Bangor, Me.	3.00	
Boonville, Mo.	4.50	
Brownsville, Tenn.	4.50	
Belfast, Maine.	4.60	10 p. c. off bills over $10; 5 p. c. off bills under $10.
Brockville, Ontario.	3.75	
Bloomfield, N J.	3.75	
Belleville, Ill.	3.50	
Bellaire, Ohio.	2.85	5 p ct. off prompt pay.
Barnesville, Ohio.	3.00	5 p ct. off prompt pay. Street lamps $17.50 per ann. Burn till 12 P. M. on moonless nights.
Boston, Mass.	2.25	
Bath, Maine.	4.00	12½ p c off prompt pay.
Bayonne City, N. J.	4.00	Net.
Binghampton, N. Y.	4.00	10 p c off prompt pay on bills for 1000 per month.
Buffalo G L Co., N Y.	2.50	10 p c off prompt pay.
Buffalo Mutual, N Y.	2.50	10 p c off prompt pay.
Buffalo Citizens, N Y.	2.50	10 p c off prompt pay.
Bloomsburg, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Burlington, Iowa.	3.75	15 p c off bills of $100, and 2g p c over $200. Street lamps $25.22 each, per annum.
Cleveland, Peoples, O	2.00	
Cumberland, Md.	3.00	
Charleston, W. Va.	4.00	25 p. ct. off prompt pay Meter rent 25, 30, and 50 cents. per m. for 3, 5 and 10 light.
Cincinnati, Ohio.	2.25	
Columbia, Mo.	4.50	
Carondolet, South St. Louis, Mo.	3.00	5 p. ct. off prompt pay,
Chattanooga, Tenn.	3.00	
Cold Water, Mich.	3.25	
Chicago, Ill.	2.50	
Columbia, Pa.	2.85	Lowe process.
Charlottesville, Va.	2.50	Meter rent 20 cents.
Cedar Rapids, Iowa.	4.50	50 cts p M. off prompt pay.
Cairo, Ill.	3.75	50 cts added if not paid by the 5th.
Cortland, N. Y.	4.00	25 cts p M. off prompt pay.
Cairo, Ill.	3.75	50 cents per month off prompt pay. For 20,000 feet a mouth $2.50.
Chillicothe, Ohio.	3.00	
Camden, N. J.	3.16	5 p c off prompt pay; 10 p c off for 100,000 per year.

Carson City, Nevada...	8.00	Gas from wood and Cannel coal.
Cadiz, Ohio.....	3.50	10 p c off on 500 feet or less; 50 cts per M. on from 500 to 2000; 20 p c off on 2000 and upwards.
Charlestown, Mass.....	2.75	
Derby, Conn.....	3.60	10 p. c. off prompt pay, and 50 cts per M. on excess of 5000 ft. per month.
Decatur, Ill.....	3.50	50 cts. per M. added, if not paid by 10th.
Danbury, Conn.....	4.28	For less than 5000 per month.
" "	3.85	For over 5000 per m th
Dover, Del.....	3.60	
Dunkirk, N Y.....	2.50	Street lamps till 12, moonless nights $25 per annum.
Defiance, Ohio.....	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Delaware, Ohio.....	3.00	No charge for meter.
East Boston, Mass.....	3.00	
East St. Louis, Ill.....	3.50	5 p. c. off prompt pay.
Evansville, Ind.....	3.00	City lamps $30.
Erie, Pa.....	3.00	City lamps $28 p. an.
Elkhart, Ind.....	3.50	
East Newark, N. J.....	4 00	
Eastchester, N. Y.....	3.50	
Elizabethtown, N. J...	3.00	
East N Y (Union) L I.	3.00	
Eastport, Me.....	4.00	
Fredericksburg, Va.....	3.40	
Flint, Mich.....	3.50	
Franklin, Pa.....	3.00	
Fall River, Mass.....	3.00	
Freeport, Ill.....	3.80	
Fort Scott, Kansas....	4.50	
Flatbush, L. I.....	3.50	
Fredonia, N. Y.....	3.00	Street lamps $25 per annum; burn fill 12 P. M.
Guelph, Ontario.....	3,50	
Geneva, N, Y.....	2.50	5 p. c. off prompt pay. Wood and oil gas.
Greensboro, N. C.....	4.00	
Galena, Ill.....	4.50	Meter rent 25 cts. per month.
" "	4.00	After September 1st.
Grand Rapiids, Mch..	2.80	For less than 1000 feet per month.
" " "	2.50	For over 1000 eet per month.
		10 per ct discount on 300,000 ft annually
Gloucester, N. J.....	3.15	5 p c off prompt pay.
Greenwich, Conn.....	2.40	Wren's process
Goshen, Ind.....	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Galesburgh, Ill.....	3.50	10 p c off prompt pay.
Huntsville, Ala.....	3.50	
Hempstead, L. I.....	4.00	
Huntingdon, Pa.....	3.80	10 per ct. off prompt pay.
Hagerstown, Md.....	3.75	
Hamilton, Ohio.....	4.00	
Hillsdale, Mich.....	3.50	
Holyoke, Mass.....	3.01	
Hartford, Conn.....	2.75	
Hornellsville, N. Y....	3.50	50 cents per 1000 off prompt pay.
Honesdal e, Pa.....	4.00	12½ cents meter rent per month.
Hannibal, Mo.....	3.00	No meter rent.
Ithaca, N. Y.....	4.00	5 p. c. off prompt pay.
Indianapolis, Ind.....	2.50	
Indiana, Pa.....	3.00	10 p. c. off prom pay Meter rent 50 cents per month.
Jersey City, N. J.....	2.75	
Joliet, Ill.....	3.50	
Jacksonville, Ill.....	4.00	12½ p.c. off prompt pay.
Jefferson City, New Orleans, La.....	4.00	
Johnstown, N Y.....	3.50	
Knoxville, Tenn.....	3.00	Meter rent 15 cents.
Lyons, N. Y.....	4.00	
Lima, Ohio.....	3.80	
Lynchburgh, Va.....	3.00	5 p. ct. added to bills not paid in 5 days.
Louisiana, Mo.....	4.50	
La Crosse, Wis.....	4.50	50 cents per M. off prompt pay.
Lancaster, Pa.....	3.00	
Louisville, Ky.....	2.70	5 p. c. off prompt pay.
La Porte, Ind.....	3.50	Wood and oil gas.
Lowell, Mass.....	2.50	25 cents per 1000 off prompt pay.
Lafayette, Ind.....	2.75	
Lexington, Mass.....	2-40	Wren's process.
Los Angelos, Cal.....	6.00	
Lockport, N Y.....	3.20	Less 20 p c per M. if paid within 30 days.
Millville, N. J.....	3.12	
Milford, Del.....	3-50	
Marquette, Mich.....	3.50	
Morris, Ill.....	2.00	For 15 candle power, or $10 per M. coal gas meter measure (Petroleum Gas—Wren's patent).
Meriden, Conn.....	3.93	
Marietta, Ohio.....	3.50	20 cts. per M. off if paid by 6th. Consumers over 3000 ft. 30 cts. additional discount.
Marshalltown, Iowa...	4.50	50 cts p M. off prompt pay.
Meadville, Pa.....	3.50	25 cts p M. off prompt pay.
" '	2.50	For over 10,000 ft. per month,
Madison, Ind.....	3.75	25 p c off if paid in five days: 25 to 40 cents per month meter rent.
Monroe, Mich.....	3.50	5 per ct off prompt pay
Malone, N. Y.....	4.50	
Middletown, Conn....	3.56	Net.
Mount Sterling, Ky....	4.50	
Monongahela, Pa.....	2.75	Under 5000 feet m'th $2.75 per M.; over 5000 feet per month $2.50 per M.
Minneapolis, Minn....	5.00	10 p c off prompt pay.
Mahanoy City, Pa.....	10.00	70 candle; 20 p c off prompt pay. Patton's process
Morristown, Pa.....	3.00	18 candle coal, an
New York, New York.	2.50	
" " Harlem....	2.75	
" " Manhattan	2.50	
" " Mutual.....	2.50	
" " Mropolitan	2.50	
" " Municipal.	2.50	Water Gas.
Nashville, Tenn.....	2.85	
Newark, Citizens, N.J.	2.85	
Norfolk, Va.....	3.10	
New Brunswick, N. J.	2.70	
Newton, N. J.....	4.00	
North Attleboro, Mass.	3.50	
New Britain, Conn.....	3.70	
New Haven, Conn.....	2.75	
Nantucket, Mass.....	3.00	Meter rent 15 cts. p. m.
Newark, N. J.....	2.85	
Niagara Falls, N. Y....	3.50	20 cts p M. off prompt pay.
Norwalk, Conn. ..	4.00	12½ p ct off prompt pay.
New Albany, Ind.....	3.00	
New City, Montreal...	2.50	Street lamps, $22 p a
Oswego N. Y.....	3.15	5 p. c. off prompt pay.
Ottawa,, Ill.....	4.00	12½ p. c. off promptpay
Omaha, Nebraska.....	5.00	
P'keepsie, Citizens....	2.70	Gwynne Harris process
Paterson, N. J.....	3.80	10 p c. off prompt pay, and in addition 5 p.c. on bills of $200; 10 p. c. on bills of $1000
Portchester, N. Y.....	3.50	
Pittsfield, Mass.....	3.50	5 p. c. off prompt pay, and 10 p. c. off on bills of $350 per an
Portland, Me.....	3.00	
Paris, Ky.....	4.50	Meter rent 25 cts. p m.
Portsmouth, N. H.....	3.22	
Pittsburgh, Pa.....	1.00	
Philadelphia, Pa.....	2.15	
Painesville, Ohio.....	3.50	
Pawtucket, R. I.....	2.80	5 p c allowed on bills of $500, and 10 p c on bills of $1500 for six months.
Providence, R. I.....	2.25	
Pottsville, Pa.....	3.50	10 p ct off promp pay,
Plainfield, N. J.....	3.50	5 p ct off for less than 5000 a month.
		10 per cent more than 5000 a month.
Peoria, Ill.....	3.50	
Paducah, Ky.....	4.00	10 p c off prompt pay.
Plymouth, Pa.....	10.00	70 candle. Patton's process.
Pottstown, Pa.....	3.20	Public lamps till 11 P. M., 18 nights per month $20 per lamp.
Poughkeepsie, N Y....	2.60	10 p c off prompt pay
Port Huron, Mich.....	3.50	
Quincy, Citizens, Mass.	5.00	
Quincy, Ill.....	3.50	
Quebec, Ont.....	2.40	
Rome, N. Y.....	3.60	
Rochester, N. Y.....	3.00	
" Citixens...	3.00	
Rondout, N Y.....	3.60	
Rockford, Ill.....	4.00	5 p c off prompt pay; 10 to 25 p c off on bills for 500 to 25 M, feet per month.
Rockford, Ill.....	3.50	For monthly bills under 1000.
" "	3.00	For ditto over 1000.
Richmond, Ind.....	3.00	50 cents added if not paid by 20th.
Syracuse, N. Y.....	2.75	
Springfield, Ill.....	3.25	$25 for city lamps.
St. Joseph, Mo.....	4.00	12½ p. ct. off on bills over $100 p. month.
St. Albans, Vt.....	5.00	10 p. c. off prompt pay, and in addition 5 p. c. off bills from $50 to $100 per month; 10 per. ct. off bills over $100.
Sandusky, Ohio.	3.00	
Saratoga, N. Y.....	5.00	20 p. c. off prompt pay, Nov. 1st to May 1st. 10 p. c. rest of year.
San Antonio, Texas....	7.00	10 per ct off from 10 to 20,000 per month 20 p ct off from 20,000 and upwards.
St. Charles, Mo.....	4.50	
Sidney, Ohio.....	3.25	
Steubenville, Ohio.....	2.50	
Sherman, Texas.....	5.00	5, 10, 15 and 20 p. c. off, according to quantity.
Salem, Oregon.....	7.00	October last reduced from $8.
Salem, Ohio.....	2.75	Meter rent 12½ cts if 300 feet is not used monthly
Sedalia, Mo.....	3.50	
Sharon, Pa.....	3.15	5 per ct off on less than 5000 feet per month. 10 p ct from 5 to 15 M. 15 p ct from 15 to 20 M. 20 per ct over 40 M.
Shreveport, La.....	5.00	
Shelbyville, Ind.....	2.00	Wren's process; $10 for 80 candle gas.
Shenandoah, Pa.....	10·00	70 candle. Patton's process.
Shamokin. Pa.....	10.00	70 candle. Patton s process.
Sunbury, Pa.....	10.00	70 candle. Patton's process.
Stockton, Cal.....	4;50	
Stamford, Conn.....	3.50	5 p c off on 15,000 per month; 10 p c off on 25,000 p month; 15 p c off on 35,000 per month. Meter rent 12½ cts and upwerds.
Tiffin, Ohio.....	3.00	
Titusville, Pa.....	3.00	
Tidioute, Pa.....	2.00	Wren's process.
Vicksburgh, Miss.....	4.50	
Wilkesbarre, Pa.....	3 50	10 p. c. off prompt pay.
Worcester, Mass.....	3.00	5 p. c. off on $500, and 10 p. c. off on $1000 in six months.
Westfield, N. Y.....	4.00	10 p. c. off prompt pay.
Washington, D. C.....	2.25	
Watertown, N. Y.....	4.50	10 p. c. off prompt pay.
Wheeling, West Va....	2.25	10 p ct off prompt pay.
Washington, Pa.....	2.50	
Woburn, Mass.....	3.00	
Waterbury, Conn.....	3.50	5 p c off on biils of $50 10 p c off on bills of $100. 5 p c added if not paid by 10th.
York, Pa.....	3.00	Meter rent 12½ cents.
Youngstown, Ohio.....	2.50	10 p. c. off on bills of $50 per month.
Youngstown, Ohio....	2.50	For monthly bills under 3000.
" "	2.25	From 3000 to 5000.
" "	2.00	From 5000.
Yonkers, N Y.....	2.00	Net.
Waterbury, Conn.....	3.00	5 p c off on bills of $50, 10 p c off on bills of $100; 10 p c added if not paid by 10th.
Washington, C H., O.	1.20	Wren's process; $6 for 80 candle gas.
Wilmington, Del.....	2.50	Street lamps 3,650 hrs per year, $31.50 per lamp.
Zanesville, Ohio.....	2.70	10 p. c. off on bills o $25 per month; city lamps $23.

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

OCTOBER 2, 1876.

DELIVERED IN NEW YORK.

English Cannel.

Ince Hall	$17 00	@	18 00
Kirkless Hall	16 50	@	17 00

English Caking Coals.

Newcastle Gas	$5 50	@	00 00
Liverpool caking	11 50	@	12 00

British Province Coals.

Pictou			2 00
Block House—At Mines, $1.87, Gold			2 00
Caledonia—At Mines, $1.50, Gold			0 00
Little Glace Bay—At Mines, $1.75, Gold			0 00
Lingan—At Mines, $1.75, Gold			0 00
Sydney—Old Mine			3 00
" Reserve, $1.75, GoldMine			0 00
" International			— —

Duty, 75 cents per ton, gold. Freight to New York $2 00 currency. Cost of above coals delivered in New York, $4 25 @ $5.25, currency.)

Pennsylvania Coals.

Penn Gas Coal—At Amboy	$5 60	@	0 00
Westmoreland—At Amboy	5 60	@	0 00
Shafton	5 60	@	0 00

(In New York, the above coals $6 00)

Youghiogheny (at New York)	6 00	@	0 00
Waverly	6 00	@	0 00

West Virginia Coals.

MurphyRun	6 00	@	0 00
Despard	6 00	@	0 00
West Fairmont	6 00	@	0 00
American Gas Coal	6 00	@	0 00
Fairmont	6 00	@	0 00
Newburgh Orrel	6 00	@	0 00
Pinnickinick	6 00	@	0 00
Cloverhill of Virginia	6 00	@	6 00
McKenzie Compound Mixture			— —

American Cannel Coals.

Peytona of West Virginia	$10 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			10 00
Red Bank—at Philadelphia			6 50
" —at South Amboy			7 25

Asphalts.

Albertite of New Brunswick	$21 00	@	— 00
Trinidad Bitumen	— —	@	14 00

The Penn Gas Coal Company have contracted with the PittsburghGas-Light Co. for their entire supply for the ensuing year from their Youghiogheny mines.

Within the last week contracts have been made by some of the companies in New York for about 200,000 tons of Penn Westmoreland, Waverly, Youghiogheny, and the West Virginia caking coals—at $6 00 per ton a reduction of 50 cents from last years' prices.

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,
24 PINE STREET, NEW YORK CITY.
OCTOBER 2, 1876.

☞ All communications will receive particular attention

Gas. Co.'s of N. Y. City.

	Capital.	*Par.*	*Bid.*	*Asked.*
Harlem	$1,850,000	50	100	106
Manhattan	4,000,000	50	235	240
Metropolitan	2,500,000	100	145	150
" Scrip	$1,000,000	..	102	—
" Bonds	500,000	1000	104	—
Mutual	5,000,000	100	110	111x
" Bonds, gold.	900,000	1000	105	—
New York	4,000,000	100	135	140
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohio	60,000	100	10	...
Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	110
Peoples, Jersey City		...	125	135
Peoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	99	100
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y.		100	50	60
Richmond Co., S. I.	300,000	...	97	100
Woonsocket, R. I.	150,000	100	100	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			99	100
St. Louis, Missouri	600,000	50	—	100
Stillwater, Minn.	50,000	50	—	26
Suburban, W'tch'str	390,000	50	—	100
Saugerties, N. Y.	15,000	100	110	115
Troy, Citizens	600,000	100	—	100
Central, Westchester	466,000	50	95	100
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	180	185
Citizens	1,200,000	20	90	95
" Scrip	320,000	1000	95	100
Peoples	1,000,000	10	45	50
Bonds	$ 325,000	...	...	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	70	75
Nassau	1,000,000	25	75	80
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	130	135
" Scrip		...	98	100
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	—	80
" Bonds	200,000	1000	—	90
Baltimore, Md.	2,000,000	100	150	170
" Ctfs., gold	1,000,000		105	—
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	95	100
" Ctfs.	53,000	—	—	—
" Bds.	124,000	—	—	—
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	—
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	152	—
Hempstead, L.	25,000	100	...	—
Jersey City	386,000	20	160	—

The following shares were sold at auction—
48 Metropolitan Gas Company, of New York, @ 145¼; $1920 Scrip, same company, @ 103¾; $16,000 Williamsburgh Gas Company's certificates, 7%, @ 99¾.

TO MANUFACTUHERS AND GAS COMPANIES.

A PRACTICAL MECHANIC WHO UNDERSTANDS THE details of Gas Machinery, Holders, etc., and erecting of same, wishes to engage with a Manufacturer or Gas Company, where the make is from 50,000 to 300,000 per day. Address MECHANIC, Box 12,604, Phil'a P. O. 415-2t

MANHATTAN LIME HURDLES.

We claim these Gas Screens to be superior to anything heretofore used for the purpose of supporting heavy moist, or light layers of lime in the purifiers of gas works. These Screens are so constructed that they will not sag, *and must not be confounded with light split rattan Screens which have been discarded on this account.*

Can be furnished at a low price. A sample sent upon application.

☞ Sample layers of these Screens may be seen in the department allotted by the Society of Civil Engineers, at Philadelphia, to exhibitors of Models of Gas Works, etc., which you are invited to examine. Orders solicited and satisfaction guaranteed.

GEORGE W. DAY, Agent,
414-6t Office 59 Washington, St,. Haverhill, Mass.

THE LANE & BODLEY CO.,

MANUFACTURERS OF

HYDRAULIC ELEVATORS

We solicit specifications from Gas Companies for Hydraulic Elevators, of the Direct or Compound form, to be operated by Water from Street Main, or from Tanks supplied by pumps for this purpose. Address for circulars

THE LANE & BODLEY CO.,
John and Water Streets, Cincinnati.

We refer to William Farmer, Esq., Gas Engineer, No. 111 Broadway, N. Y

Cincinnati Gas-Light and Coke Co., three machines, Cincinnati; Laclede Gas Co., two warehouses, St. Louis; Evansville Gas Co., one warehouse, Evansville, Ind.; Newark Gas Co., one warehouse, Newark, N. J; Pittsburg Gas Co., Pittsburg; Washington Gas Co., two warehouses, Washington, D. C. 414-1 y

TO GAS COMPANIES.

FOR SALE, IN LOTS TO SUIT.

TWO HOLDERS—one with Iron Columns and Girders.

HYDRAULIC (4 inch) STAND PIPES, MOUTH PIECES and Covers for two benches of Threes.

Three IRON RETORTS—Condensers, Washer, and Washer Tank.

Three Round (4 feet) PURIFIERS and Covers, with Center Seal and connections, Station Meter and several Dry Meters.

Apply at the office of this Journal. 423

WANTED TO LEASE.

A GAS WORKS OF ANY CAPACITY, FROM 1,000 TO 10,000 feet Coal Gas per day, by a practical gas maker Parties having such to lease will please send particulars to

E. W. GUILD,
412-2t 13 Bassett St., Providence, R. I.

Wanted to Purchase for Cash.

A GAS WORKS IN A TOWN OF FROM TEN TO FIFTEEN thousand inhabitants. Address HAMILTON GAS LIGHT AND COKE CO., Hamilton, Ohio. 412 t

TO GAS-LIGHT COMPANIES.

WANTED—A SITUATION IN A GAS WORKS. THE undersigded (a young man) who has had seven years experience, connected with the operations of gas works wishes to engage himself as Superintendent of a works where the make is 5,000 to 50,000 per diem, or will accept a position in any department connected with operations of works. Address SUPERINTENDENT, care of M. COOMBS, Jr.' Engineer Gas Co., Youngstown, Ohio 412-uni

FOR SALE,

A HALF INTEREST IN A SMALL GAS WORKS WILL be sold, or leased to a practical gas man. Two thousand feet of natural gas per day. Address

J. SHACKELTON,
405-tf Westfield, N. Y.

WHEELER & WINTERTEEN,

INSPECTORS OF

Gas Meters and Repairers.

Gas Companies having Meters to be repaired will please inform us. The best references given from different Gas Companies and State Inspectors. Address for terms, office 1513 Fourteenth St., Washington, D. C. 411-3m

NOTICE TO GAS COMPANIES.

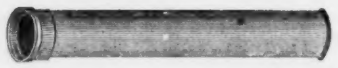
WANTED—A SITUATION BY A YOUNG MAN, who has had upwards of Nine Years experience in Repairing and Fixing Gas Meters. Has had some experience in Gas Fitting, etc.; willing to make himself generally useful. Good references given. Address to C. McKAY, 342 Milwaukee street, Milwaukee, Wisconsin. 409-8t

JAMES MARSHALL & CO.

Franklin Foundry and Pipe Works,

MANUFACTURERS OF

GAS, WATER, AND OIL PIPES,



Works, 18th, 19th, 20th and Railroad Street.
Office, No. 23 Nineteenth Street.
Pittsburgh, Pa.

N.B.—Pipes from 8 inch and upwards cast in 12 ft. lengths.
☞ Send for Circular and Price List

NATIONAL FOUNDRY

AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,

PITTSBURGH, PA

WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, an all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.
☞ SEND FOR CIRCULAR AND PRICE LIST. ☜

S. DECATUR SMITH,

CAST IRON GAS & WATER PIPE,

Foundry, Cor. of York and Moyer Streets,
PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

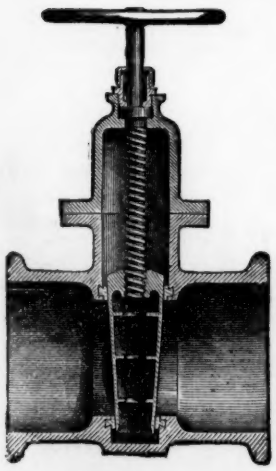
☞ FITTINGS OF ALL KINDS FOR GAS AND WATER MAINS. ☜

CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.



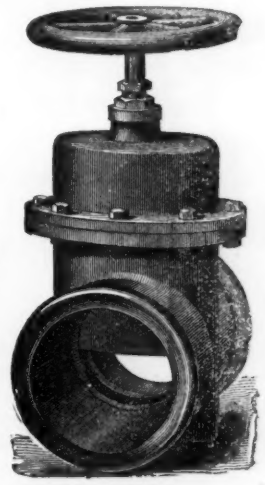
These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is no LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

We refer to the following named Gas-Light Companies among the many that have used these Valves:



BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.

SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH, N. Y.

GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.

STEAM VALVES ½ INCH TO 72 INCHES DIAMETER.

857-tf

Advertisers Index.

GAS BURNERS, APPARATUS, ETC.

American Meter Co.—West 22nd st., N. Y., Arch and 22d st., Phil., 548 Washington st., Boston.
Cast Iron Gas and Water Pipe—S. Decatur Smith, York and Moyer streets, Phila., Pa.
Cast Iron Gas and Water Pipes—R. D. Wood & Co., Philadelphia Pa.
Cast Iron Gas and Water Pipe—McNeal & Archer, Burlington, N. J.
Clay Gas Retorts, etc.—Gardner Bros., 96½ Fourth Avenue, Pittsburgh, Pa.
Cast-Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md.
Cast Iron Pipes for Water and Gas—Riley A. Brick, 112 Leonard street, N. Y.
Cast Iron Gas and Water Pipe, etc.—H. R. Smith & Co., Columbus, Ohio.
Gas Valves (Chapman) 75 and 77 Kilby st., Boston, Mass.
Gas-Burners—C. Gefrorer, 248 North 9th st., Phila., Pa.
Gas Purification—St. John and Cartwright, 21st and Avenue A, New York.
Gas Meters, etc.—Harris, Griffin & Co., 12th and Brown streets, Phila., Pa.
Gas Meters, etc.—Wm. W. Goodwin & Company, 1012 Filbert street, Phila, Pa.
as Meter Manufacturers—Harris, Helme & McIlhenny, 1117 Cherry st., Philadelphia, Pa
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway
Gasholders, Etc.—Delly & Fowler, 39 Laurel st., Phila., Pa.
Gas-Light Company of America, 63 and 64 Drexel Building, New York.
Gasholders—George Stacey & Co., Ramsay st., Cincinnati, O.
Lava Tips and Scotch Tips—Charles H. Meyer & Co., 227 Chestnut street, Phil. Pa.
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Avenue C., N. Y.
Patent Gas Exhauster—Smith & Sayre, 95 Liberty sttreet.
Pelouze & Audouin Condenser—Jas. R. Smedberg, Sole Agent for U. S. San Francisco, Cal.; Henry Cartwright, 2107 Green street, Phil. Pa.
Patent Gas Exhauster—S. S. Townsend, Agt., 31 Liberty street, N. Y.

GAS COALS

Cannelton Coal Co. of West Virginia—J. Tatnall Lea 325 Chestnut street, Phila, Pa.
Canuel Chips—H. E. Hoy, 34 New street, N. Y.
Despard Coal Co.—Parmelee & Bros. Agents 32 Pine st. New York.
Gas Coals—Perkins & Job, 27 South st., N. Y.
New York and Cleveland Gas Coal Company—384 Penn Avenue, Pittsburgh, Pa.
National Coal Gas Company—H. P. Allen, 4 Warren st., N.Y.
Penn Gas Coal Co.—11 Merchants' Exchange, Phil. and 90 Wall street, N. Y.
Peytona Cannel Coal—S. E. Low, 58 Broadway, N. Y.
Tyrconnell Gas Coal—52 S. Gay Street, Baltimore, Md.
Youghiogheny Coal—Perkins & Job, 27 South St. N. Y.
Scotch Cannel Coals—James McKelvie, Cannel Coal Merchant, Haymarket, Edinburgh.

FOUNDRIES.

Atlantic Dock Iron Works—John P. Kennedy, Office 98 Liberty street, N. Y. P. O. Box 2348.
Continental Works—T. F. Rowland, Greenpoint.
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Son.
Franklin Foundry and Pipe Works—Jas. Marshall & Co., 23 Nineteenth street, Pittsburgh, Pa.
Gloucester Iron Works—J. P. Michellon, Sec., 6 North 7th street, Phila., Pa.
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman & Wilkins streets, Pittsburg, Pa.
Oregon Iron Foundry—Herring & Floyd, 740 Greenwich street, N. Y.
Pascal Iron Works—Morris, Taskar & Co., Philadelphia.

WATER METERS, PUMPS, ETC.

Valves for Water, Steam and Gas—Ludlow Valve Man'g Co., 940River street, Troy, N. Y.

CLAY RETORT WORKS.

B. Kreischer & Son, Clay Retorts, etc., 58 Goerck st., N. Y.
Cheltenham Fire Brick and Clay Retort Works—Evens & Howard, 916 Market street, St. Louis, Mo.
Clay Retort and Fire Brick Works—Edward D. White, Van Dyke street, Brooklyn, N. Y.
Manhattan Clay Retort Works, 15th st., near Av. C, N. Y.
Philadelphia Fire Brick Works, Vine and 23d sts., Phila,
Clay Gas Retorts, etc., etc.—J. H. Gautier & Co., cor Greene and Essex streets, Jersey City, N. J.

LAMPS, STOVES, PETROLEUM, ETC.

Lamps—M. B. Dyott, 114 South 2nd Street, Phil. Pa.
Patent Lamp Post—J. W. Graham, Chillicothe, Ohio, or A. M. Callender, office of this Journal.

MISCELLANEOUS.

Architect and General Gas Engineer—William Farmer, 61 Broadway Room 95, N. Y.
Brass Cocks, Plumbers' Materials, etc., etc.—McNab & Harlin Manufacturing Co., 56 John st., N. Y.
Contractors for Gas Works, Etc.—Murray & Baker, Fort Wayne, Ind.
Cathell's Improved Retort Settings—A. M. Callender & Co., 42 Pine street. N. Y.
Fodell's System of Bookeeping—A. M. Callender & Co., 42 Pine st., New York.
Lowe Gas Process—S. A. Stevens & Co., Sole Agents, Room 27. Astor House, N. Y.
Gas Engineer—B. E. Cholar, 914 Olive St., St. Louis, Mo.
Kidd's Gas Consumers Guide—A. M. Callender & Co., 42 Pine Street, N. Y.
Portland Cements—S. L. Merchant & Co., 76 South st., N. Y.
Screening Shovels—Herring & Floyd, 740 Greenwich street New York.
Scientific and Practical Chemist and Geologist—Profetsor Henry Wurtz, 12 Hudson Terrace, N. J.
Screening Shovels—A. See & Son, 1258 Broadway, N. Y.
Screening Shovels—Torrance, Merriam & Co., Troy, N. Y.
Strap File and Binder—A. M. Callendar & Co., 42 Pine street, Room 18, N. Y.
nited States Hoisting and Conveying Company, 115 Broadway, N. Y.
Wren's Gas Works—Cor. Jay and Water sts., Brooklyn, N. Y.

JOHN P. KENNEDY,

SUCCESSOR TO

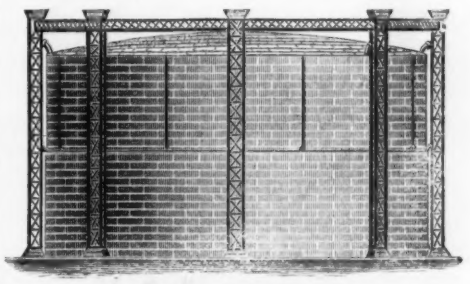
Hoy, Kennedy & Co.,

GAS ENGINEER AND CONTRACTOR

For the Erection, Alteration and Extension of Gas Works.

PLANS, SPECIFICATIONS AND ESTIMATES.

Office 111 Liberty Street. P. O. Box 2,348



AGENT FOR THE

ATLANTIC DOCK

Iron & Machine Works,

FERRIS, WOLCOTT AND DYKEMAN STREETS,

South Brooklyn.

MANUFACTURERS of every kind of Gas Machinery, Retorts Bench Castings, Wrought Iron Work, Multitubular and Air Condensers, Washers, Scrubbers, Purifiers, Exhausters with every equipment complete for large or small Works,

GAS-HOLDERS,

TELESCOPIC OR SINGLE;

Iron Roof Frames with Cornice Gutters, covered with Corrugated Iron or Slate; Iron Doors and Iron Pivot Blind Windows; Coke Barrows, Fire Tools, Retort Lids, Cotter Bars and Screws, Stop Valves, Tar Valves for Regulating Dip in Hydraulic Mains, Pressure Governors for Street Mains, and Compensators for Exhausters that are unrivaled for unvarying accuracy Steam Engines, Boilers, Etc. Etc.

Post Office Box 2,348. Office 98 Liberty street.

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 11 Merchants Exchange, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

cknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 ubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in		Sulphur in			Specif. Gravity.	
		Coal.	Coke.	Coke.	Ootl.	Volatile Matter.	Coal.	Gas.
35.1	64.9	2	6	.82	1.48	.66	1.289	.476

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb.. —gave 16 14-100 Candle-Power.

COKE, of very fine quality—**1453** pounds produced from one ton of coal.

SALES AGENTS { **J. TATNALL LEA**, Treasurer, P. O. Box 1747 Philadelphia. **PERKINS & JOB**, 27 South Street, N. Y.; 91 State Street, Boston. **H. W. BENEDICT & SON**, New Haven.

SCOTCH CANNEL COALS.

THE SUBSCRIBER IS PREPARED TO CONTRACT FOR the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be orwarded on application.

JAMES McKELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

ESTABLISHED 1840. 357-1y

WREN'S GAS WORKS.

W. C. WREN,

Corner of Jay and Water Streets,

BROOKLYN. N. Y.

HAVING GRANTED THE USE OF ONE OF my Patents to the Gas-Light Company o America, and settled my claim against them. I inform the profession that I continue to erect the Works known as

Wren's Gas Works,

and sell Licenses to use my Patents for making Gas from Petroleum.

Gentlemen of the profession:—As your consumers demand a better light, and as that demand has been in many cases sought in vain to be met by using different abortive imitations of my various processes, would it not be well to make success sure by trying the plan of the inventor.

You can enrich your Coal Gas to any desired standard, by using my process, in the simplest manner, and much cheaper hanby *any other* method. Address as above. 397

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.

Company's Office, No. 52 S. Gay Street, Baltimore, Md.

C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.

CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

SINCLAIR & AGNEW, Agents, Alexandria, Va.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

294-1y n

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.

BANGS & HORTON, No. 31 Duane street, Boston.

Mines in Harrison County, West Virginia.

Wharves Locust Point, Company's Office, 15 German St., } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

*** Reference to them is requested 904-

NEW YORK AND CLEVELAND
GAS COAL COM'Y

Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation. on most favorable terms.

General Office—384 Penn Avenue, PITTSBURGH, PA.

Branch Office—C. & P. RR. Coal Pier, CLEVELAND, OHIO.

WILLIAM A. McINTOSH, President.
A. CARNEGIE, Vice-President.
W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY, Agent at Cleveland, Ohio.

351-1y

PEYTONA
CANNEL COAL

From West Virginia.

Yields over 13,000 feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over 43 candles. Purifies 4,510 feet to the bushel of lime.

S E. LOW, Secretary,
Office, 58 Broadway.

OFFICE OF THE

NATIONAL COAL GAS COMPANY,

No. 4 Warren Street, New York.

H. P. ALLEN, President.
I. B. BRICE, Vice-President.
A. H. ALLEN, Secretary.
WM. J. VALENTINE, Treasurer.
GEORGE W. HARRIS. Engineer.

This Company is the owner of the GWYNNE-HARRIS, or AMERICAN HYDROCARBON process, for making Gas for Lighting or Heating purposes, by the perfect decomposition of superheated steam, under what is known as the

GWYNNE AND HARRIS PATENTS.

This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

The process can be put into either Coal or Oil Gas Works (or where both Coal and Oil are used) at small cost, without any interruption to the working of other benches. The Citizens Gas-Light Company of Brooklyn, after using it for more than seven months, have found it not only far better, but actually *cheaper* than atmospheric air in making Gas, with the use of "petroleum and its products"

Further information, and terms of sale of rights will be given, upon application to the Company 348-1y

Portland Cement,
Roman Cement,
Keene's White Cement,

English Fire Brick, No. 1, $35 per M.

" Silica Fire Brick, $60 "

IMPORTERS.

S. L. MERCHANT & CO.,

76 South Street, New York,

Corner Maiden Lane. 344-1y

☞ Remit 10 cents postage for "Practical Treatise on Cement."

B. E. CHOLLAR,
GAS ENGINEER,

914 OLIVE STREET, ST. LOUIS, MO.

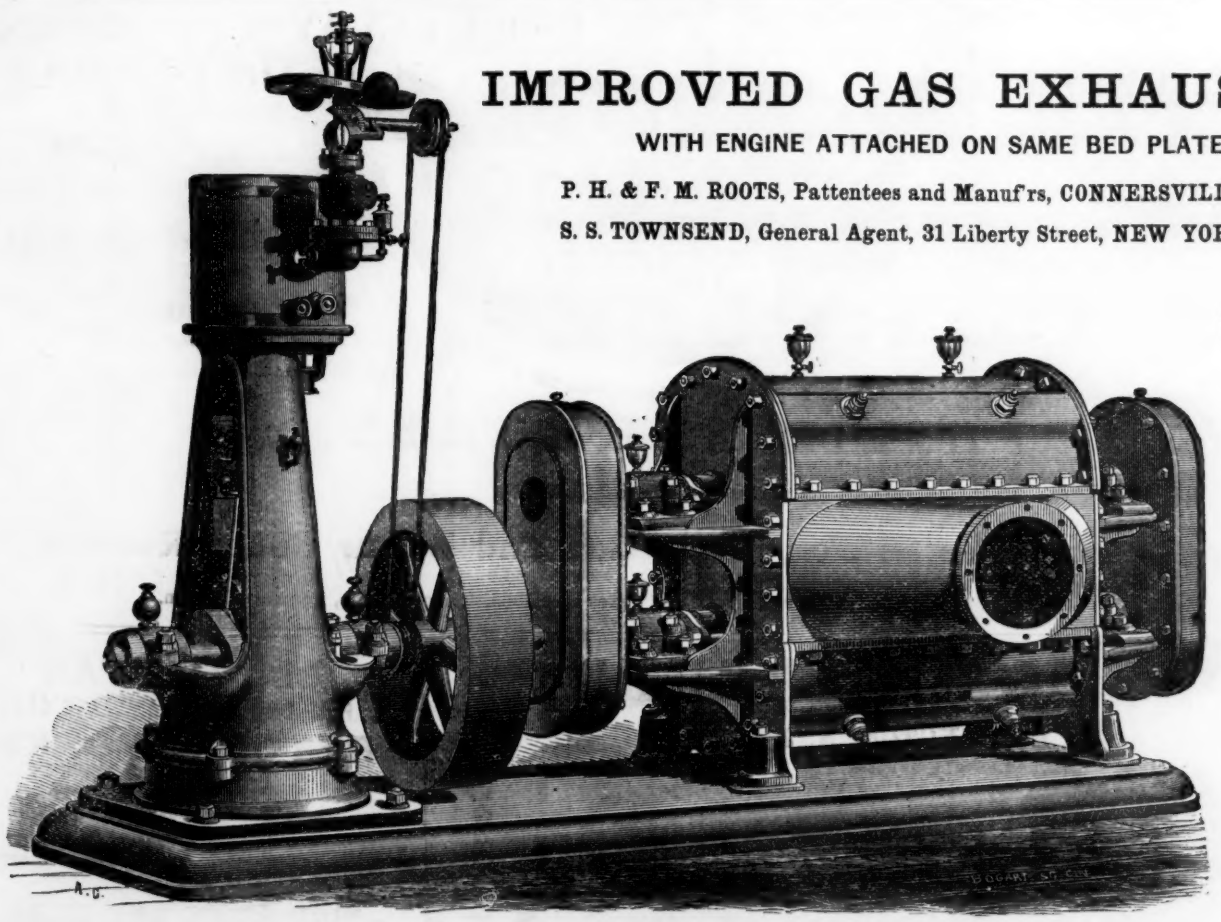
355-

IMPROVED GAS EXHAUSTER,

WITH ENGINE ATTACHED ON SAME BED PLATE.

P. H. & F. M. ROOTS, Pattentees and Manuf'rs, CONNERSVILLE, IND.

S. S. TOWNSEND, General Agent, 31 Liberty Street, NEW YORK.



ADVANTAGES CLAIMED FOR THIS EXHAUSTER.

1. It is simpler than any other Exhauster. The internal operating parts consist of only two pieces, cast entire, and can not get out of order.
2. Every part requiring care or attention, is external and easily accessible. All changes, adjustments, and repairs are made from the outside.
3. The revolvers, though practically gas-tight, do not run in actual contact, hence there is no friction, and a great saving of power effected.
4. They are built in the most complete and substantial manner, and of any required size, with steel shafts and improved journal bearings.
5. We furnish Exhausters and Engines combined on same Bed Plate, as shown above, or the Exhauster only, as may be required.
6. We also furnish Bye Passes and Gas Valves on improved plans, also Exhauster Governors and Elbows, Pipes, Drawings, etc.

Send for Illustrated Catalogue, giving details of capacity, speed, power required, price, and references to parties using them.

P. H. & F. M. ROOTS.

THE WAVERLY COAL AND COKE CO.

Offer for Sale the

YOUGHIOGHENY COAL

DOUBLE SCREENED,

from their Colliery at Smith's Mills, on the Youghiogheny River, thirty-seven and a half miles southerly of Pittsburgh. This Coal has the preference in Pittsburgh over all other YOUGHIOGHENY COAL for GAS PURPOSES.

The facilities of the WAVERLY COMPANY are unsurpassed by those of any other Company on the Youghiogheny.

Full particulars can be had by addressing

PERKINS & JOB, Agents,
27 South Street, New York.
91 State Street, Boston.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,

ALWAYS ON HAND.

J. H. GAUTIER.
C. E. GREGORY.

393-1y

CHAS. H. MEYER & CO.,

227 Chestnut Street, Philadelphia, Pa.,

IMPORTERS OF

LAVA TIPS AND SCOTCH TIPS.

ALL ORDERS DELIVERED FREE TO NEW YORK.

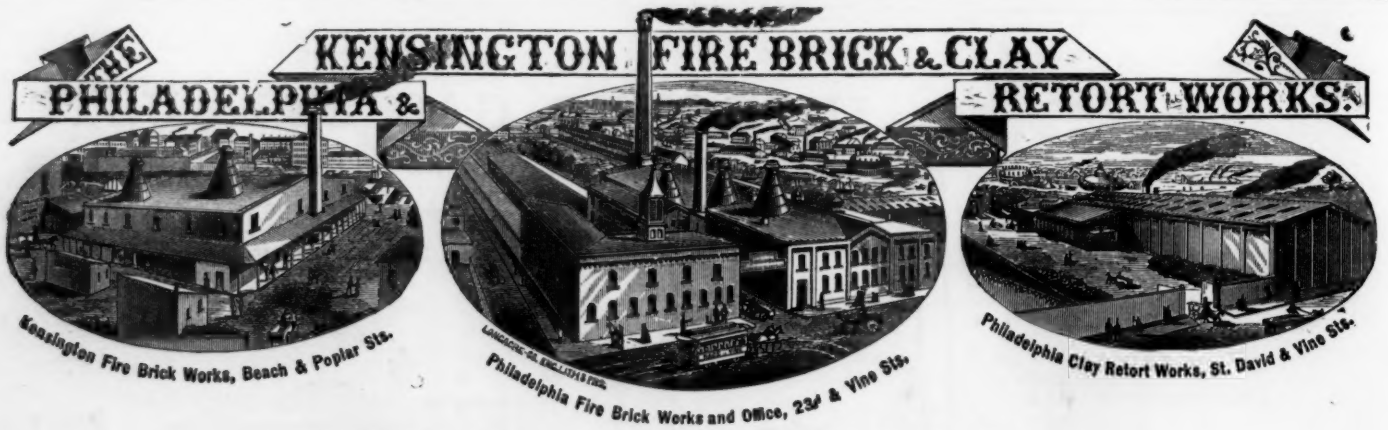
359-1y

FOR SALE,

200 Tons

CANNEL CHIPS.

Address H. E. HOY,
34 New Street, N. Y.


THE
PHILADELPHIA &
KENSINGTON FIRE BRICK & CLAY
RETORT WORKS.
Kensington Fire Brick Works, Beach & Poplar Sts.
Philadelphia Fire Brick Works and Office, 23d & Vine Sts.
Philadelphia Clay Retort Works, St. David & Vine Sts.

PHILIP NEUKUMET,

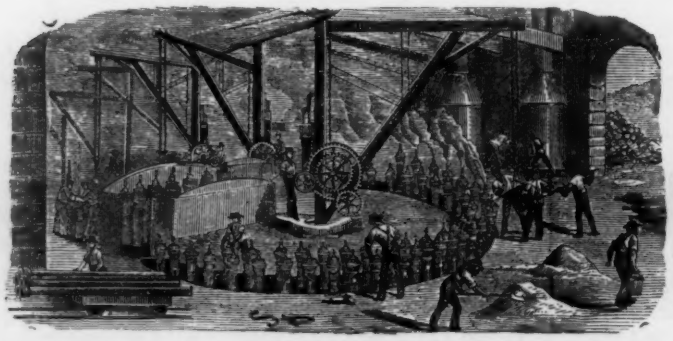
(SUCCESSOR TO JOHN NEUKUMET),

Manufacturer of Fire Bricks, Tiles, Gas and Sugar House Retorts.

☞ Plans of Settings for Benches of Threes, Fives, and Sixes furnished, free of charge, upon application.

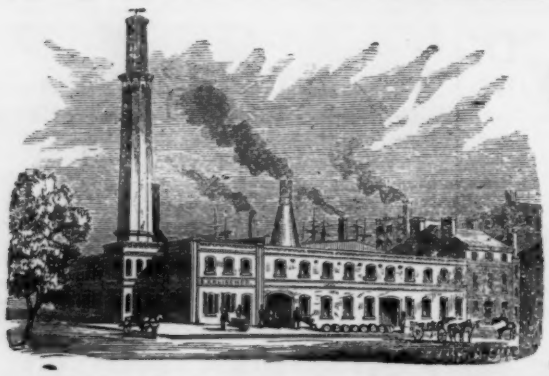
M'NEALS & ARCHER,

BURLINGTON. N. J,



CAST IRON PIPES

FOR WATER AND GAS.



NEW YORK

FIRE BRICK AND CLAY

Retort Works.

☞ *Established in* 1845. ☜

(Branch works at Kreischerville, Staten Island.)

B. KREISCHER & SON,

OFFICE,

58 Goerck Street, cor. Delancy, N. Y

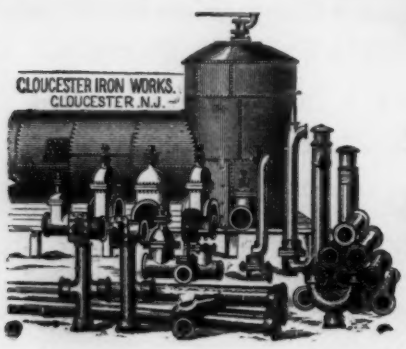
GAS RETORTS, TILES & FIRE BRICK

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

Articles of every description made to order at th shortest notice.

B. KREISCHER & SON



Gloucester Iron Works,

OFFICE—NO. 5 NORTH SEVENTH STREET,

PHILADELPHIA.

DAVID S BROWN, Pres't. JAMES P. MICHELLON Sec'y

BENJAMIN CHEW, Treas. WILLIAM SEXTON Sup't.

CAST IRON GAS AND WATER PIPE.

Cast Iron Heating and Steam Pipe. Stop Valves. water or Gas.

Fire Hydrants,

GAS HOLDERS.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS.

ADAM WEBER,

(Successor to MAURER & WEBER.)

[PROPRIETOR.

Office and Works, 15th Street, Avenue C

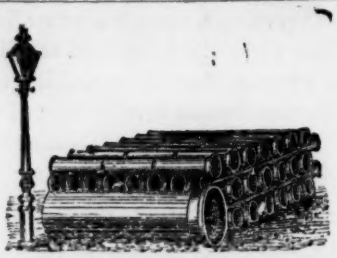
Manufactures of

FIRE BRICK AND TILES,

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

☞ Articles of every description made to order at shor notice. 1)5



R. D. WOOD & CO.,

PHILADELPHIA.

MANUFACTURERS OF

CAST IRON PIPE

FOR GAS AND WATER

Lamp Posts, Valves, Etc.

Mathew's Pat. Anti-Freezing Hydrants,

400 Chestnut Street.

H. R. SMITH & CO.,

COLUMBUS, OHIO,

MANUFACTURERS OF

CAST IRON GAS & WATER PIPE,

BRANCH CASTINGS, LAMP POSTS, Etc.

(Pipe from three inch and upwards cast *vertically* in 12 feet lengths.)

HEAVY AND LIGHT CASTINGS OF ALL KINDS.

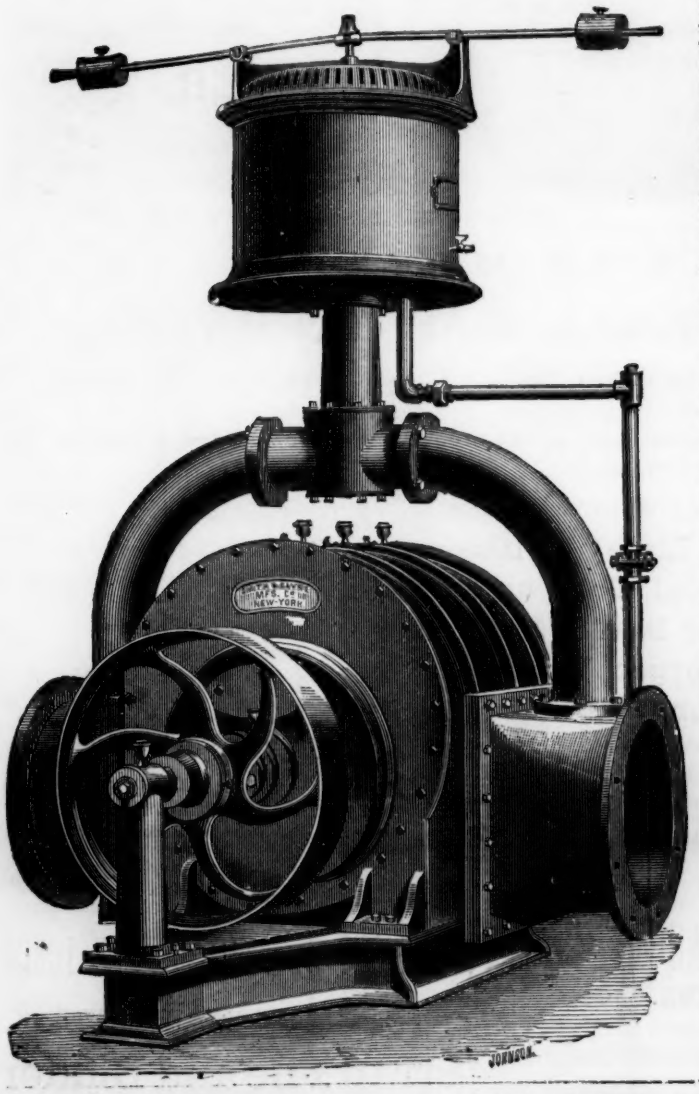
DAILY CAPACITY 125 *TONS.*

☞ Our Works *connect direct* with *eleven railroads* centering in this city, giving us unequalled facilities for shipping o all points, at the lowest rates of freight. 405-1y

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan and 33 per cent fuel. Address

The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time required by the old style Cupola

JAMES M. SAYRE, Treasurer. G. G. PORTER, President.

CHARLES W. ISBELL, Secretary. OFFICE 45 LIBERTY STREET, New York.

T. DEAN, Pres't. } OFFICE OF {H. N. SMITH, Treas.
S. F. DEWEY, V. Pres. } {CHAS. F. DEAN, Sec.

THE GAS-LIGHT CO. OF AMERICA

Nos. 63 and 64 Drexel Building,

P. O. Box, 5131. NEW YORK.

THE GAS-LIGHT COMPANY OF AMERICA, owners of the Patent Processes for making ILLUMINATING GAS from PETROLEUM and its products, known as the

Gale and Rand
AND
Wren and Barker Patents,

are prepared to treat with Gas Companies and Manufacturers of Gas for the use of said processes.

An examination of the merits of these inventions as demonstrated by practical experience in a large number of Gas Works employing them, will not fail to convince the intelligent Gas Manufacturer of the great advantages derived from their use.

Gas of unexceptional quality, of high illuminating power is made at many of these works by these processes, at a cost of from 40 per cent. to 60 per cent. less than an ordinary quality of illuminating gas can be made by any other methods in use. Gas Companies generally may easily, and at small outlay for making the necessary changes in manufacturing apparatus, double their net earnings, and supply a much better light to their patrons, at greatly reduced prices.

The Company respectfully refer to Companies using these processes in this city, Reading, Penn., Chicago and elsewhere, and especially to the Mutual Gas-Light Company of Detroit, Mich., whose works more nearly conform in all details of construction to the original plans of the inventors, than those of other Companies.

For Correspondence, etc., address to office as above.

CHARLES F. DEAN, Secretary.

1842. DEILY & FOWLER 1876.

LAUREL IRON WORKS.

ADDRESS, 39 LAUREL STREET,

PHILADELPHIA.

MANUFACTURERS OF

GAS HOLDERS,

SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers, Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. Previous to 1868 our Mr. D. built *nine Gas Works* and *fifty-four Holders*. Since that date we have built *three Gas Works* and *forty-six Holders*. We *superintend in person* the erection of all our work, and would refer to the Gas Companies at the following places, where we have built Holders, since 1868:

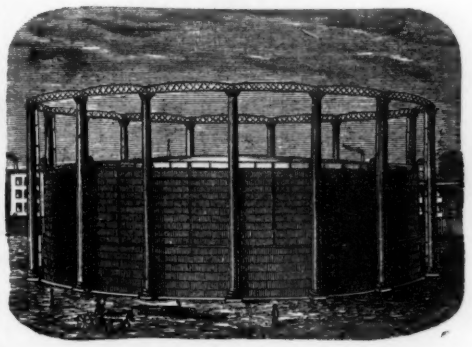
Lancaster, Pa.
Williamsport, Pa.
Bristol, Pa.
Catasaqua, Pa.
Kittanning, Pa.
Hazelton, Pa.
Freeport, Pa.
Huntingdon, Pa.
Pittston, Pa.
Bethlehem, Pa.
Sharon, Pa.
Canton, Pa.
Annapolis, Md.
Parkersburg, West Va.
Lynchburg, Va.
Youngstown, O.
Steubenville, O.
Zanesville, O.
Mansfield, O.
Marion, O.
Bellcaire, O.
Athens, O.
Barnesville, O.
Franklin, Ind
Jacksonville, Ill. (3)
Joliet, Ill.
Lawrence, Kansas.
Jefferson City, N. O., La.
Algiers, N. O., La.
Kalamazoo, Mich.
Buffalo, N. Y.
Ogdensburg, N. Y.
Waverly, N. Y.
Little Falls, N. Y.
Penn Yann, N. Y.
Watkins, N. Y.
Gloucester, N. J.
Salem, N. J.
Mount Holly, N. J.
Plainfield, N. J.
Englewood, N. J.
Dover, Del.
Pittsfield, Mass.
Meriden Conn.

T. F. ROWLAND,

Continental Works,

GREENPOINT, BROOKLYN, N. Y.

ENGINEER AND MANUFACTURER OF



GAS-HOLDERS

OF ANY MAGNITUDE,

Condensers, Scrubbers, Purifiers, Retorts, Hydraulic Mains and all other articles connected with the Manufacture and Distribution of Gas, furnished with despatch. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Office in Philadelphia No. 435 Chestnut St., where a member of the Firm can be seen between 12 m. and 2 p. m. daily.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

GAS HOLDERS,

TELESCOPIC AND SINGLE,

With cast iron guide and suspension frames. GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 226-tf

JESSE W. STARR. JESSE W. STARR, JR.

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little scarcely any clinker. 34-1y

MITCHELL, VANCE & CO.,

Manufacturers of

CHANDELIERS!

And Every Description of

GAS FIXTURES,

Also Manufacturers of

Fine Gilt Bronze and Marble Clocks, warranted best Time-Keepers, Mantle Ornaments, &c.

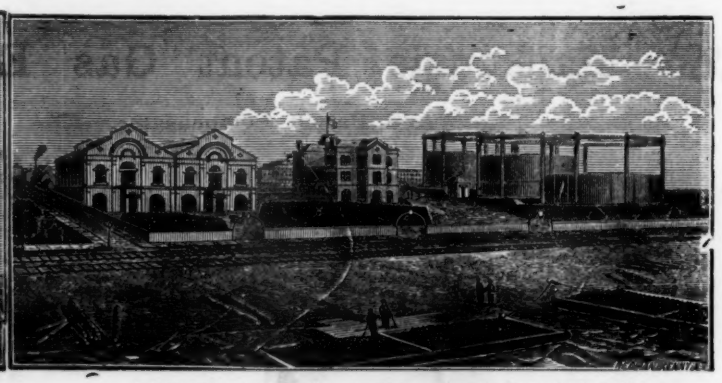
Salesroom, 597 BROADWAY,

Rear Entrance 140 Mercer Street,)

NEW YORK.

Special designs furnished for Gas Fixtures for Churches Public Halls, Lodges, &c.

CINCINNATI GAS WORKS. ERECTED 1871-72-73.—WM FARMER, ENG.



LACLEDE GAS WORKS, ERECTED 1872.—WM. FARMER, ENG.

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

REFERENCES:

GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
Professor B. SILLIMAN, New Haven, Conn.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco, Cal.
Prof. HENRY WURTZ, 12 Hudson Terrace, Hoboken, N. J.

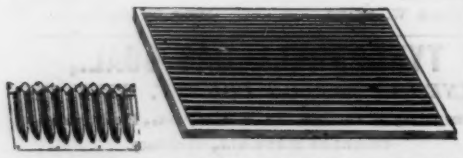
To Gas Companies.

CHEESMAN'S

CONICALLY AND DIAMOND SLOTTED

SOLID WOOD TRAYS.

PATENTED OCTOBER 21, 1862 AND JUNE 10, 1873.



The above Trays are made from half inch to one and a quarter inch thick with a strong centre piece, bars bevelled on top. Also the Diamond Bar Tray can be used either side up smoothest and most durable Trays in use. They are now used by more than three hundred Gas Companies in the United States and other places.

JOHN L. CHEESMAN,
151 and 153 Avenue C, New York.

GEO. W. DRESSER,

CIVIL ENGINEER.

TRINITY BUILDING

ROOM 90. 111 BROADWAY

THE LOWE GAS PROCESS.

S. A. STEVENS & CO,

SOLE AGENTS.

ROOM 87, ASTOR HOUSE.

P. O. Box 1110, NEW YORK.

AND

400 430 WALNUT STREET, PHILADELPHIA.

THE ATTENTION OF

MANUFACTURERS OF COAL GAS

is called to a new Process for Making Gas from the Hydrocarbons distilled from Bituminous Coal at a low temperature and Water Gas, insuring a five-fold increase, and the greatest possible economy and convenience in manufacture.

For particulars see paper on Coal Gas, as published in this Journal March 2nd, 1876, or inquire of

Dr. M. W. KIDDER,
401-12t 47 India Street, Boston.

FOR SALE,

A PURIFYING APPARATUS, CONSISTING OF A SIX inch Condenser of 24 columns, 20 feet high, with By-Pass; four Set Washers, 12 inch diameter by 9 feet high, with By-Pass; four round Purifiers 6 feet diameter by 3 feet deep; seven tiers of Trays (cast iron), Covers and Counter Balances, and one 6-inch Dry Centre Valve and Connections.

The above Apparatus is in first rate order, and will be sold cheap. For particulars address

THOS. F. KENDRICK, Sec.
402-4t Nashville Gas-Light Co.

GEORGE H. MORRISON,

Importing Tailor

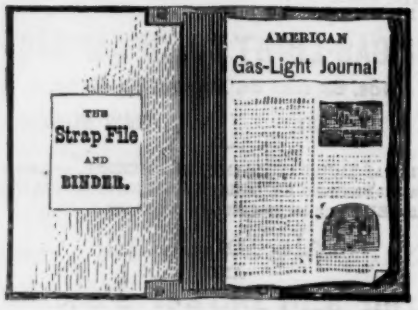
No. 23 East Fifteenth Street,

(Bet. 5th Ave and Union Square.) 397-1y

Keep the Journal for Reference.

HUTCHINSON'S PATENT

Strap File and Binder



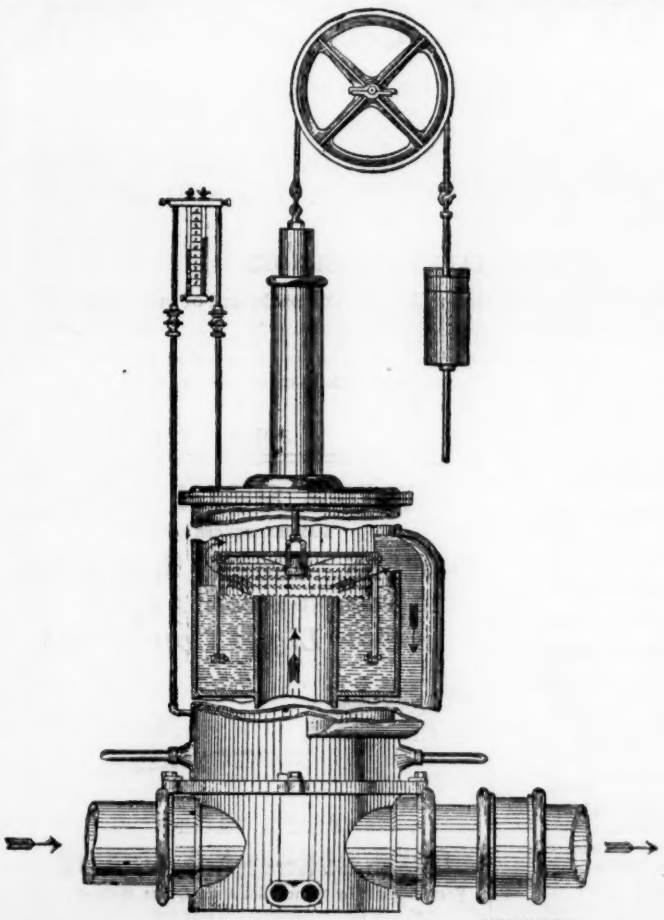
ADVANTAGES OF THE STRAP FILE.

1st. It is simple, strong, and easily used.
2nd. Preserves papers without punching holes.
3rd. Will always lie flat open.
4th. Allows any paper on file to be taken off, with out disturbing the others.

We will furnish to our subscribers this important article for *preserving in a convenient form*, the numbers of the Journal as it is issued, at the very low price of **$1.25**. Se either by Express or Mail, as directed.

By Mail the postage will be **20** cents, which will be add to the price of the Binder. Send orders to

A. M. CALLENDER & CO.,
42 Pine Street, Room 18 New York.



ADDRESS

OR

Sole Agency for the United States.

THE

Pelouze & Audouin Condenser.

PATENT MAY 26, 1874.

With SMEDBERG'S COMBINED BYE-PASS, REVERS FLOW, and DIFFERENTIAL GAUGE.

PATENT JULY 21, 1874.

This apparatus is based upon the recent discovery by Messrs. PELOUZE & AUDOUIN of the principle of Condensation by impact, or percussion.

All gas-makers are aware how difficult it is to separate all the Coal Tar and Water from Crude Coal Gas by mere cooling; and how frequently these liquids are swept on to the purifiers, even where scrubbers or washers of large size and considerable cost are employed.

The PELOUZE & AUDOUIN CONDENSER completely arrests these by-products, increasing the quantity of Coal Tar available for fuel or sale, reducing the tendency of the purifying material to cake on the trays, and yielding a gas-liquor of remarkable strength. Hence, all the processes of purification are facilitated, while its simultaneous arrest of heavy percentages of Naphthaline reduces the risk of stoppages to a minimum.

The subordinate patent of July 21, 1874, combines a Bypass with he Condenser, and thus saves to the purchaser the cost and slow action of three valves, together with the space occupied by these valves and the necessary connections.

The Differential Gauge is so constructed that there is no oscillation of its water-columns; while it indicates inlet pressure, outer pressure, or back-pressure, at the will of the observer.

IT IS POSITIVELY GUARANTEED THAT EVERY CONDENSER SHALL BE OF PERFECT MECHANICAL CONSTRUCTION, AND SHALL DISCHARGE ITS FUNCTIONS SATISFACTORILY.

The Condensers are now used or ordered by the following American Gas Works: San Francisco, Cal. (3); Louisville, Ky. (2); Oakland, Cal. (1); New Orleans, La. (1); Salt Lake City, Utah (2); Philadelphia, Pa. (1); Newark, Ohio (1); Indianapolis Gas Company.

The following European Gas Works are also using the Condenser with satisfactory results:

St. Mandé; Ternes; Armintières; Reims; Bome; Liège; Schaffhouse; Ivry; St. Denis; Château Thierry; Douai; Florence; Berne; Loclé; Belleville; Versailles; Orléans; Courrières: Geneva; Vevey; Batavia; Frankfort-on-the-Main, and about thirty others.

The Paris Gas Company, sending out a daily December maximum of about twenty-five millions cubic feet, has adopted this Condenser at each of its ten stations.

JAMES R. SMEDBERG, Consulting Engineer,
San Francisco Gas-Light Company.
HENRY CARTWRIGHT, C. E., 2107 Green Street, Philadelphia, Pa.

GAS PURIFICATION.

St. John and Cartwright's
NEW IRON COMPOSITION

as purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime.* Takes out *all the ammonia.* Now operating in the following Gas Works: Harlem New York (21st street); Port Morris; Hunter's Point; East New York Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St, Albans, Vt.; Pawtucket, R. I.; Meriden, Ct., and being introduced in many other places.

Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500 $250 additional for each additional 50,000 per day.

For further information and instructions, apply to

ST. JOHN & CARTWRIGHT,
21st Street and Avenue A, New York Gas Works.

☞ Immediate arrangements are urged, as the demand for the prepared composition is increasing *so rapidly* that delays in supply may occur.

GEO. STACEY. HENRY RANSHAW WM. STACEY.

GEO. STACEY & CO.,

MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS,

AND ALL KINDS OF

Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39.

Office and Wrought Iron Works on RAMSAY STREET Cincinnati, Ohio.

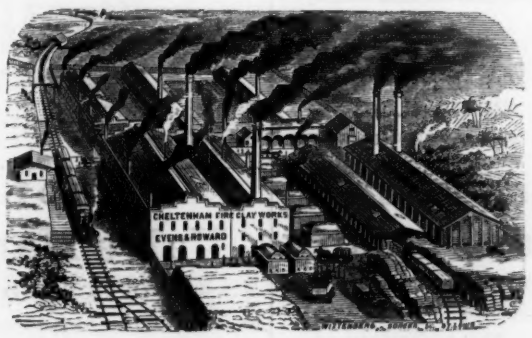
REFERENCE.

Cincinnati Gas-Light Co.	Baton Rouge, La., Gas Co.
Indianopolis Gas Co.	Saginaw, Mich., Gas Co.
Dayton, O., Gaslight Co.	Oshkosh, Wis., Gas Co.
Covington, Ky., Gas Co.	Peoria, Ill., Gas Co.
Springfield, O., Gas Co.	Quincy, Ill., Gas Co.
Terre Haute, Ind., Gas Co.	Champaign, Ills., Gas Co.
Madison, Ind., Gas Co.	Carlinville, Ill., Gas Co.
Kansas City, Mo., Gas Co.	Bowling Green, Ky., Gas Co.
Topeka; Kansas, Gas Co.	Hamilton, Ohio, Gas Co.
Burlington, Iowa, Gas Co.	Vicksburg, Miss., Gas Co.
Nashville, Tenn., Gas Co.	Denver City, Cal., Gas Co.

R. T. Coverdale, Eng'r Cincinnati, and others.

EVENS & HOWARD,

Clay Gas Retorts
Retort Settings,
Fire-Brick,



Clay, &c.
Ground Fire
Drain Pipe, Fine

OFFICE, 916 MARKET STREET, ST. LOUIS, MO.

GOODS CAREFULLY PACKED IN CARS AT WORKS FOR ALL POINTS.

CAMPBELL, BRICK & CO.,

MANUFACTURERS OF

CAST IRON PIPES,

FOR WATER AND GAS,

Office 112 Leonard Street, N. Y.

ROBERT CAMPBELL.
RILEY A. BRICK.
W. W. CAMPBELL.

Brooklyn Clay Retort

AND

FIRE-BRICK WORKS,

VAN DYKE STREET, BROOKLYN, N. Y.

EDWARD D. WHITE, Surviving Partner of the late firm J. K BRICK & CO. 402-1y

Gas Engineers,

AND PARTIES ENGAGED IN THE BUILDING OF

GAS WORKS,

who desire information regarding PETROLEUM GAS, either for use pure or for enriching, are requested to address, ing particulars.

J. D. PATTON,
363-un1 Treverton, Northumberland Co. Pa.

KIDD'S

Gas Consumers' Guide

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to ther egistration of their meters. For sale by

A. M. CALLENDER & CO.,
42 Pine Street, New York, Room 19,

1849. HARRIS, GRIFFIN & CO., 1876.

12th and Brown Streets, Philadelphia, Penna.

and 49 DEY STREET, NEW YORK CITY.

Manufacturers of WET AND DRY GAS METERS, STATION METERS, SHOW AND TEST METERS, METER PROVERS, PRESSURE REGISTERS AND INDICATORS, BAR AND JET PHOTOMETERS, WET AND DRY CENTER VALVES, and all Apparatus pertaining to Gas Works in their line.

Patentee and Sole Manufacturer of the ORIGINAL and ONLY CORRECT GAS EXHAUST GOVERNOR.

We hereby caution all parties against making, vending, or using any GAS EXHAUST GOVERNOR that will be an encroachment of our patent.

The support and confidence of Gas Companies, so long enjoyed by us, encourage us to pursue the same undeviating course that has contributed to establish the character of our house, and with our extended experience and increased facilities, develop the latest improvement that Science can apply, in the construction of Gas Meters, etc., and thereby merit a continuance of the favors hitherto so liberally extended to us, always guaranteeing satisfaction.

ANDREW HARRIS. JOHN J. GRIFFIN.

NOW READY AND FOR SALE,

FODELL'S

System of Bookkeeping

FOR GAS COMPANIES.

Price $5, which should be sent either in Check, P. O. Order, or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P. FODELL, Philadelphia, or

A. M. CALLENDER & CO.,
Office GAS-LIGHT JOURNAL, 42 Pine St., N.Y.

McNAB & HARLIN MAN'FG CO.

MANUFACTURERS OF

BRASS COCKS

FOR STEAM, WATER AND GAS.

Plumbers Materials.

WROUGHT IRON PIPE

Gas and Steam Fitters' TOOLS.

56 JOHN STREET, N. Y.

☞ Illustrated Catalogue and Price sent on application,
378-3m

HERRING & FLOYD,

Oregon Iron Foundry

38, 740, 742 and 744 Greenwich St,, N. Y

MANUFACTURERS OF

ALE KINDS OF CASTINGS

AND

APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.

WASHERS: MULTITUBLAR AND AIR CONDENSERS: CONDENSERS; SCRUBBERS,

and dry), and
EXHAUSTERS
for relieving Retorts from pressure.
BENDS and BRANCHES
of all sizes and description.

FLOYD'S PATENT
MALLEABLE RETORT LID.

SABBATON'S PATENT
FURNACE DOOR AND FRAME.

SELLER'S CEMENT
for stopping leaks in Retorts.

GAS GOVERNORS,

and everything connected with well regulated Gas Works, at low price, and in complete order.

N. B.—STOP VALVES from three to thirty inches—at very low prices.

SILAS C. HERRING, JAMES B. LO .

GRAHAM'S

Patent Anti-Freezing LAMP POST.

THE BEST, CHEAPEST AND MOST DURABLE POST EVER OFFERED TO THE PUBLIC.

WOOSTER, OHIO
Jan. 24, 1871.

J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,
LUCAS FLATTERY
Sec'y Wooster Gas-Light Co.

Address the Patentee,
J. W. GRAHAM,
259-9t Chillicothe, Ohio.

LUDLOW Valve Manf'g Co.,

OFFICE AND WORKS

938 to 954 River Street and 67 to 83 Vail Ave

TROY, NEW YORK.

BRASS AND IRON SLIDE VALVES.

(Double and Single Gate ¾ inch to 36 inch—outside and inside screws, Indicator etc.) for Gas, Water and Steam—

HYDRAULIC MAIN DIP REGULATORS.

ALSO

FIRE HYDRANTS.

REFERENCES FURNISHED.

SEND FOR CIRCULARS.

NEW YORK SHOVEL WORKS.

MANUFACTURERS OF

SHOVELS, SCOOPS & SPADES.

SHOVELS AND SCOOPS A SPECIALTY

For Gas-Light Companies.

DEAN'S PATENT

COKE SCREENING SCOOPS.

Frames are 12 by 18 inch, seven bars, best Malleable Iron. They can be mad to screen any size desired.

A. SEE & SON,
404-1y 1358 Broadway, N. Y.

REMOVAL.

BUTLER'S PATENT Coke and Coal

SCREENING SHOVELS

MADE FROM BEST MALLEABLE IRON AND STEEL.

FURNISHED WITH LONG OR D HANDLES

Perfect in their operation. is very strong, and from their great durability vastly more economical than any substitute. Refer to all the principal gas Companies in the country, who acknowledge them as the "ne plus ultra of Coke Screening Shovels.

Ordersaddres
HERRING & FLOYD,
Sole Agents,
740 Greenwich St., N. Y.

☞ I still retain the original SABBATON LETTERS PATENT, and have granted no rights or privileges to any other parties.

Prof. Henry Wurtz,

Chemist and Geologist.

Offers his professional services, in the field and the laboratory, in the investigation, by the most recent and advanced scientific methods, of all questions of Water supply of towns dwellings, factories, steam-boilers, etc. Chemical Analyses of River; Lake, Spring and Well-Waters, made by the most improved methods.

Prof. W. makes a specialty of GAS CHEMISTRY, and the Analysis of Gas, Gas and other Coals, and Potable Water Has special laboratories and unequalled facilities for thes purposes. Formerly Chemical Examiner in the U. S Patent Office, and peculiarly competent.

MUEL DOWN, President. WM. H. HOPPER, Vice-Pres't. WM. N. MILSTED, Sec. and Treas. T. C. HOPPER, Gen'l Sup't

AMERICAN METER COMPANY,

MANUFACTURERS OF

Wet and Dry Gas Meters (with Slide or Rotary Valves), Station Meters, Dry Centre Valves, Pressure Registers, Pressure and Vacuum egisters, Meter Provers, King's Pressure and Vacuum Gauges, Exhauster Governors, Experimental Meters, Watchman's Clocks, Etc., Etc.

☞ Sole Agents for W. SUGG'S **PHOTOMETRICAL** and **ANALYTICAL GAS APPARATUS.**

A full assortment of the above kept at the Manufactories and Agencies, where orders may be addressed,

Agencies.

37 Water Street, Cincinnati.
20 South Canal Street, Chicago.
511 Olive Street, St. Louis.

American Meter Compauy,

512 West Twenty-sceond Street, New York.
Arch and Twenty-second Street, Philadelphia.
548 Washington Street, Boston.

HARRIS, HELME & McILHENNY,

Successors to Harris & Brother.

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

ontinue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.,

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

rom our long Practical Experience of the Business (covering a period of 28 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

WASHINGTON HARRIS. WILLIAM HELME. JOHN McILHENNY.

WILLIAM W. GOODWIN & CO.

No. 1012, 1014 and 1016 Filbert Street,

Philadelphia, Penn'a.

MANUFACTURERS OF

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Goodwin's Improved Lowe's Jet Photometer.

W. W. Goodwin is the author of the History and Principles involved in the use of Lowe's Jet Photometer. Also Patentee and we are the SOLE MANUFACTURERS of the ORIGINALand ONLY DIAL whereby the CANDLE POWER and PRESSURE can be instantly read, and all others are infringements.

Special attention to repairs of Meters, and all apparatus connected with the business.

All work guaranteed first class in every particular, and orders filled promptly.

WILLIAM WALLACE GOODWIN. [335 1y] HOWARD KIRK, Special Partner.

CENTENNIAL DRAWINGS.

Prospective or Geometrical Drawings f Buildings and Apparatus, suitable for Exhibition Purposes. Finest work. Address

F. H. MULLER.
126 East 52nd Street, N. Y.

GARDNER BROTHERS,

MANUFACTURERS OF

Clay Gas Retorts, Retort Settings, Fire Bricks, Etc.

Works, Lockport, Westmoreland Co., Pa.)
Office, 96½ Fourth Avenue,
PITTSBURGH, PA.

J. R. SCOTT,
en'l Agent for New England,
Wasnington St., Boston.

MURRAY & BAKER,

Practical Builders,

And Contractors for the Erection of Gas Works,

MANUFACTURERS OF ALL THE LATEST AND MOST IMPROVED APPARATUS AND TOOLS FOR THE MANUFACTURE & DISTRIBUTION OF COAL GAS.

☞ WORKS AT THE RAILWAY DEPOTS,

FORT WAYNE, INDIANA.

We manufacture Bench Castings, Washers, "The Immersed Multitubular," and Atmospheric Condensers, Wet and Dry-Lime Purifiers, Dry Center Seals, Telescopic and Single Gas Holders, Wrought Iron Trussed Roof for Iron or Slate; Wood and Iron Trays for Purifiers, Coke and Coal Carts, Wrought Iron Screening Shovels and Castings, and Wrought Work of every description for Gas-Works.

As Mr. Murray is a Practical Draughtsman, we will furnish plans and specifications to parties or associations, or will wait personally upon parties contemplating the construction of new works, or the alteration or extension of old ones

The most satisfactory references can be given, if required of the experience and commercial fairness which characterizes our dealings.

We would respectfully invite Western men to call and see our patterns and works here. MURRAY & BAKER,
Fort Wayne, Indiana.

B. S, BENSON.

MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet

[Office & Factory 52 East Monument St.,

BALTIMORE, MD.

C. CEFRORER.

Manufacturer of

GAS BURNERS,

GAS HEATING AND COOKING APPARATUS.

FITTERS' PROVING APPARATUS, ETC.

No. 248 North Eighth Street, Philadelphia.

MORRIS, TASKER & CO., Limited.

PASCAL IRON WORKS, PHIL'A.

DELAWARE IRON CO., NEWCASTLE, DEL.

OFFICE, NO. 209 SOUTH THIRD STREET, PHILADELPHIA.

Office and Warehouse, 15 Gold Street, New York.

Office and Warehouse, 36 Oliver Street, Boston, Mass.

FOR GAS WORKS MACHINERY, ADDRESS OFFICE, 209 SOUTH THIRD STREET, PHILADELPHIA.

Manufacturers and Builders of Gas Works, of all Descriptions, of the latest improved Plans.

WROUGHT IRON ROOF FRAMES.—For Slate, or Corrugated Iron Coverings, with Cast Iron Cornice Gutter. Iron Doors and Frames, Wrought Iron Pivot Blinds, Windows and all kinds of Castings and Smith Work for Buildings.

BENCH CASTINGS.—Retorts, and all Castings and Wrought Iron Work required for Setting them on the Latest Plan. Tar Gates, Wrought Iron Stand Pipes, Retort Lids, Cotter Bars, Coal and Coke Wagons and Stokers' Tools.

EXHAUSTERS.—Exhausters and Compensators, By-Passes to pass from 4,000 to 150,000 cubic feet of Gas per hour, with Engines, Governors, Pressure and Vacuum Gauges.

SCRUBBERS.—Single or Multitubular Scrubbers, with Self-Acting Pumps for Ammonia Water.

WASHERS.—Cataract and Single and Multitubular Spray Washers.

CONDENSERS.—Single and Multitubular Air and Water Condensers.

PURIFIERS.—For Purifying from 1,000 to 2,000,000 cubic feet capacity daily, with either wet or dry Lime, or Oxide of Iron, and with either Ash Rivetted or Wrought or Cast Iron Lime Sieves.

CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating, Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

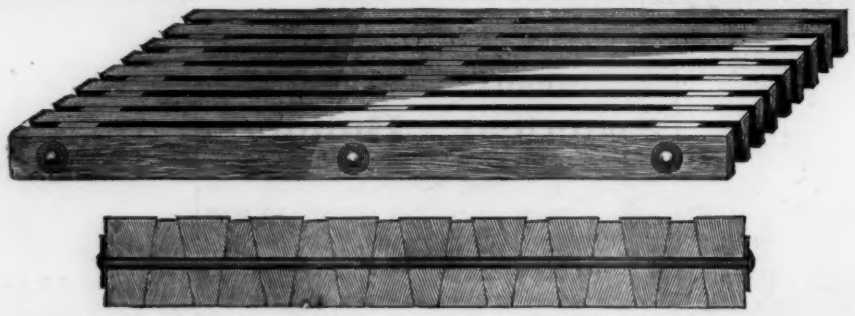
Sole agents and manufacturers of Morton and Holman's, and Munzinger's **Patent Self-Sealing Retort Lids.**

Manufacturers of **Wrought Iron Welded Tubes,** Plain, Galvanized and Rubber Coated, for Gas, Steam, and Water.

Lap-welded Charcoal Iron **Boiler Tubes.**

Oil Well Casing and Tubing. Gas and Steam Fittings. Improved Sugar Machinery.

P. Munzinger's Patent Ash Lime Trays.



In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas-Light Company, N. Y.
Utica Gas-Light Company, N. Y.
Jersey City Gas Company, N. J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. Y.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas-Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kans.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.